SECTION 11610

GLOVEBOXES

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LANL MASTER CONSTRUCTION SPECIFICATION

This specification is a general specification covering a wide range of nuclear materials glovebox applications. It is to be used for design/build procurements and for internal design combined with external build-to-print procurements. Design and fabrication sections shall be used when formulating glovebox design/build specifications. The design sections shall be used to create design-only specifications when establishing design "contracts" with internal LANL design groups. In that instance, the fabrication requirements shall be used to create a build-to-print specification for the fabrication procurement. The specification requires project-specific editing to add requirements that reflect the interfaces with the processes and equipment that are being enclosed. It requires deletion of requirements that pertain to specific applications that are not pertinent. Employ design verification personnel to review and approve the specification, verifying that applicable sections of the specification have been maintained. Ultimate responsibility for defining applicable requirements associated with design and fabrication of gloveboxes lies with the author. To seek a variance from applicable requirements, contact the Construction Specs Mechanical discipline POC.

This specification primarily defines requirements for design and fabrication of stainless steel gloveboxes used for confinement of nuclear materials. Other materials may be used for the design and fabrication of the glovebox, including aluminum, provided that the process and corrosive requirements inside the glovebox are met. Redefine the specification requirements when specifying a glovebox fabricated from a material different than stainless steel.

This specification is most applicable to new acquisitions, but may have application with modifications or repair work to existing gloveboxes.

Gloveboxes specified herein are typically designated as Management Level (ML-2) systems at LANL. Perform work in the development of this specification for project specific purposes under a quality assurance program qualified in accordance with ASME NQA-1 or 10 CFR 830.120. Develop the specification under the purview of a Quality Assurance Program Plan and QA Manual that meet the basic requirements for design as defined in the aforementioned section.

During development of this specification, consult with the facility authorization basis team on the impacts of the glovebox on the facility authorization basis. Where necessary, develop an Unreviewed Safety Question Determination (USQD) and follow change processes developed by the facility of installation.

NOTE: Portions of this specification consist of quotations and paraphrases from the American Glovebox Society, Guideline for Gloveboxes, AGS-G001-1998. In the interest of providing a useable and readable specification, quotations and paraphrases have not been footnoted throughout the text. Paraphrases and quotations have been identified in italics. The users of this specification are encouraged to review the Guideline for Gloveboxes and to use the guideline appropriately.

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PART 1 GENERAL

1.1 SECTION INCLUDES

A. Glovebox Shells

B. Open-Front Boxes

C. Airlocks

D. Glovebox Support Stands

E. Gloveports

F. Windows

G. Filter Housings

H. Shell Penetrations

I. Access and Service Panels

J. Material Transfer Devices

K. Radiation Shielding

L. Glovebox Linings

M. Pressure Relief Devices

N. Other Glovebox Appurtenances

1.2 SCOPE

A. This specification establishes the technical requirements for the design, materials of construction, fabrication, testing, shipment, and quality assurance (QA) of gloveboxes, their support stands, and components or appurtenances of gloveboxes.

B. The technical requirements of this specification are applicable to gloveboxes used for the primary and secondary confinement of nuclear materials. Additional technical requirements are provided in the contract drawings. Any additional requirements specific to a given glovebox are identified in contract documentation identified in Division 1 documents.

C. The following is a summary of supplier responsibilities described in this specification:

1. Design gloveboxes in strict accordance with this specification, the contract drawings, and the referenced documents.

2. Furnish design data required by this specification to document design of the glovebox.

3. Provide a design schedule showing major design steps, submittal milestones, review periods, and as-built documentation. Provide a revised design schedule after any modification to the contract documentation, which revises the design requirements, required delivery date, or when other approved LANL changes otherwise change a scheduled design task.

4. Fabricate gloveboxes in strict accordance with this specification and the contract drawings.

5. Procure equipment, materials, or supplies to complete the work, unless otherwise stated.

6. Test and inspect as required by this specification.

7. Furnish the data required by this specification to document that required tests and inspections have been performed.

8. Package, ship, and deliver gloveboxes.

9. Provide LANL full access to the facility for performing random or scheduled inspections and/or surveillance of work performed.

10. Provide LANL with a lower tier services plan including the name, address, telephone number, and point of contact for outside services that the supplier intends to use on this project. Identify the specific work requirements of this specification that will be performed by those outside services.

11. Provide a fabrication schedule showing fabrication steps, hold points, tests, and inspections. Provide a revised fabrication schedule after any modification to the contract document, which revises the required delivery date, or when other approved LANL changes otherwise change a scheduled assembly step hold point, test, or inspections.

12. Provide seven (7) working days advance notice of a hold point activity requiring LANL witness or inspection.

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Edit applicable related sections defined below to meet the project requirements associated with the glovebox to be designed and fabricated.

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1.3 RELATED SECTIONS

A. Section 01000: Scope of Work

B. Section TBD: Special Provisions

C. Section 01015: LANL/Contractor Furnished Property and Services

D. Section 01300: Submittals

E. Section 01600: Materials and Equipment

F. Section 01630: Product Options and Substitutions

G. Section 01700: Contract Closeout

H. Section 01720: Project Record Documents

I. Section 05120: Structural Steel

J. Section TBD: Stainless Steel

K. Section 05500: Metal Fabrications

L. Section TBD: Glovebox Installation

M. Section 13085: Seismic Protection

N. Section 15190: Mechanical Identification

O. Section 15215: Compression Fittings on Copper and Stainless Steel Tubing

P. Section 15885: HEPA Filtration Systems

Q. Section 15990: Testing, Adjusting and Balancing (becoming 15995)

R. Section TBD: Glovebox Pressure Relief Devices

S. Section TBD: Glovebox Atmosphere Regeneration Systems

T. Section TBD: Glovebox Gloves

U. Section TBD: Glovebox Instrumentation

V. Section TBD: Hermetically-Sealed Glovebox Feedthroughs

W. Section 16111: Conduit

X. Section 16112: Surface Metal Raceway

Y. Section 16120: Building Wire and Cable

Z. Section 16130: Boxes

AA. Section 16195: Electrical Identification

BB. Section 16450: Secondary Grounding

CC. Section 16510: Interior Lighting System

1.4 DEFINITIONS

A. Access Panel: A removable and resealable panel used for interior access.

B. Airlock: A transition enclosure for material movement into and out of the glovebox that maintains the primary confinement. The term "transfer airlock" is sometimes used interchangeably with airlock. An airlock is sometimes purged with inert gasses.

C. LANL: Los Alamos National Laboratory operated by the University of California (UC) for the Department of Energy (DOE).

D. Certificate of Conformance (CoC): Document provided by the supplier stating that the item received conforms to the applicable requirements.

E. Glovebox: A controlled environment enclosure providing primary confinement from the work area. Operations inside gloveboxes are performed through sealed glove openings for the protection of the worker, the environment, and/or the process.

F. Hood: An enclosure similar to a chemical fume hood. A non-isolated enclosure for controlled access to a glovebox that may also be used independently as a stand-alone unit or in a line with other hoods. Confinement is achieved through airflow in a hood. Hoods can also be used for low-level analytical chemistry operations. Can also be referred to as an Open-Front Glovebox, Introductory Glovebox, or Radio-Benches. For the purposes of this specification only, the term Hood will be used interchangeably with Open-Front Glovebox, Introductory Glovebox, and Radio-Bench.

G. Primary Confinement: The barrier (structure) that is directly in contact with bulk radioactive material. The barrier, that if breached exposes the bulk radioactive material. Primary confinement is pipes and vessels in a tritium system. Primary confinement in an SNM process may be process piping and vessels or may be the glovebox when solids are exposed in machining and handling processes.

H. Secondary Confinement: Secondary confinement is a structure erected around primary confinement for the purposes of creating a barrier to block migration of unanticipated and anticipated breaches of the primary confinement. Gloveboxes are secondary confinement in a tritium system or a wet chemistry SNM process where they isolate releases of radioactive materials when the process piping must be opened.

I. *Shielded Gloveboxes: A shielded glovebox is a glovebox provided with radiation shielding. Depending on process conditions, certain gloveboxes may be shielded by the addition of gamma shielding and/or neutron shielding covering the front, sides, back, and bottom of the glovebox as required. This shielding may be covered by stainless steel.*

J. Supplier: A contractor providing services to LANL.

1.5 ACRONYMS

A. ACGIH: American Conference of Governmental Industrial Hygienists

B. AGS: American Glovebox Society.

C. AISI: American Iron and Steel Institute

D. ALARA: As Low As Reasonably Achievable.

E. ANSI: American National Standards Institute

F. ASME: American Society of Mechanical Engineers

G. ASNT: American Society of Nondestructive Testing

H. ASTM: American Society for Testing and Materials

I. AWS: American Welding Society

J. B&PVC: Boiler and Pressure Vessel Code

K. CD: Capacitive Discharge

L. CFR: Code of Federal Regulation

M. CMAA: Crane Manufacturers Association of America

N. CMTR: Certified Material Test Report

O. CoC: Certificate of Conformance

P. CRL: Central Research Laboratories

Q. DBE: Design Basis Earthquake

R. DOE: Department of Energy

S. ICBO: International Council of Building Officials

T. IES: Illuminating Engineering Society of North America

U. LANL: Los Alamos National Laboratory

V. LIR: Laboratory Implementation Requirement

W. NDE: Nondestructive Examination

X. NEC: National Electric Code

Y. NFPA: National Fire Protection Agency

Z. NPH: Natural Phenomena Hazard

AA. NQA: Nuclear Quality Assurance

BB. OSHA: Occupational Safety and Health Administration

CC. PQR: (Welding) Procedure Qualification Record

DD. QA: Quality Assurance

EE. QC: Quality Control

FF. SAE: Society of Automotive Engineers

GG. SDDR: Supplier Deviation Disposition Request

HH. SSC: Structures, Systems, and Components

II. SSPC: Steel Structures Painting Council

JJ. UBC: Uniform Building Code

KK. UC: University of California

LL. UL: Underwriters Laboratories

MM. WPS: Welding Procedure Specification

NN. WPQ: Welder Performance Qualification Record

1.6 REGULATORY REQUIREMENTS

Codes, specifications, and standards referred to by number or title form a part of this specification to the extent required by the following references and others that may exist in this document. Use codes, specifications, and standards referenced below of the latest revision at the time of award of contract, unless otherwise stated below.

A. 10 CFR 830.120: Quality Assurance

B. 10 CFR 835: Occupational Radiation Protection

C. 10 CFR 1910: Occupational Safety and Health Administration (OSHA) Standards

D. ACGIH: Industrial Ventilation

E. AGS-G001-1998: Guideline for Gloveboxes

F. ANSI/ANS 8.1: Nuclear Criticality Safety in Operations With Fissionable Materials Outside Reactors

G. ANSI/IEEE 1023: Guide for the Application of Human Factors Engineering

H. ASME B18.2.1: Square and Hex Bolts and Screws Inch Series Including Hex Cap Screws and Lag Screws

I. ASME B30.16: Overhead Hoists

J. ASME B30.2 1: Manually lever operated Hoists

K. ASME B46.1: Surface Texture

L. ASME Boiler and Pressure Vessel Code (B&PVC), Section II – Part C: Material Specifications – Welding Rods, Electrodes, and Filler Metals

M. ASME B&PVC, Section V: Nondestructive Examination

N. ASME B&PVC, Section VIII – Division I, Pressure Vessels

O. ASME B&PVC, Section IX: Welding and Brazing Qualifications

P. ASME HST-4M: Performance standard for Overhead Electric Wire Rope Hoists

Q. ASME HST-3M: Performance standard for Manually lever operated Hoists

R. ASME NOG-1: Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)

S. ASME NQA-1-1997: QA Program Requirements for Nuclear Facilities

T. ASME Y14.5M: Geometric Dimensioning and Tolerancing

U. ASNT SNT-TC-1A: Recommended Practice

V. ASTM A36: Structural Steel

W. ASTM A182: Forged or Rolled Alloy Steel Pipe Flanges, Forged Fittings and Valves, and Parts for High-Temperature Service

X. ASTM A193: Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service

Y. ASTM A194: Carbon and Alloy Nuts for Bolts for High-Pressure and High-Temperature Service

Z. ASTM A240: Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet and Strip for Pressure Vessels

AA. ASTM A276: Stainless and Heat-Resisting Steel Bars and Shapes

BB. ASTM A307: Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

CC. ASTM A325: High-Strength Bolts for Structural Joints

DD. ASTM A354: Quenched and Tempered Alloy-Steel Bolts, Studs, and Other Externally Threaded Fasteners

EE. ASTM A479: Stainless and Heat-Resisting Steel Bars and Shapes for use in Boilers and other Pressure Vessels

FF. ASTM A480: Flat Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip

GG. ASTM A511: Seamless Stainless Steel Mechanical Tubing

HH. ASTM A554: Welded Stainless Steel Mechanical Tubing

II. ASTM A563A: Carbon and Alloy Steel Nuts

JJ. ASTM A572: High-Strength Low-Alloy Columbium-Vanadium Steels

KK. ASTM B29: Pig Lead

LL. ASTM B209: Aluminum and Aluminum-Alloy Sheet and Plate

MM. ASTM C1036: Flat Glass

NN. ASTM C1172: Laminated Architectural Flat Glass

OO. ASTM E499: Methods of Testing for Leaks Using the Mass Spectrometer Leak Detector in the Detector Probe Mode

PP. ASTM F593: Stainless Steel Bolts, Hex Cap Screws, and Studs

QQ. ASTM F594: Stainless Steel Nuts

RR. AWS A2.4: Symbols for Welding, Brazing and Nondestructive Examination

SS. AWS D1.1: Structural Welding Code Steel

TT. CMAA Specification No. 70

UU. DOE/EH 0256T: Radiation Control Manual

VV. DOE Order 5480.5: Safety of Nuclear Facilities

WW. DOE Order 6430.1A: General Design Criteria (Division 11)

XX. DOE-STD-1020: Natural Phenomena Hazards (NPH) Design and Evaluation Criteria for Department of Energy Facilities

YY. DOE-STD-1021: NPH Performance, Categorization Guidelines for SSCs

ZZ. LANL Facility Drafting Manual, Volume 2

AAA. LANL LIR 230-01-02: Management Level Determination

BBB. LANL LIR 402-300.01: Criticality Safety

CCC. LANL LIR-402-700-01: Occupational Radiation Protection Requirements

DDD. LANL LIR 402-1000-01: Personnel Protective Equipment

EEE. NFPA 70: National Electrical Code

FFF. NFPA 101: Code for Safety to Life from Fire in Buildings and Structures

GGG. SAE J429: Mechanical and Material Requirements for Externally Threaded Fasteners.

HHH. SSPC SP-1: Solvent Cleaning

III. SSPC SP-6: Commercial Blast Cleaning

JJJ. UL: Underwriters Laboratories

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The author is required to define many aspects of the glovebox design. Designate management level of the glovebox in accordance with LIR 230-01-02, Management Level Determination. Following the designation of management level, interpret the requirements for the designated management level and define those requirements in this specification.

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1.7 DESIGN

A. Some glovebox drawings have been previously produced for repeated use in LANL glovebox design. A drawing list is provided in Attachment 1 of this specification. Use existing, proven designs as represented in Attachment 1, where available. Provide any new designs in compliance with the requirements of this specification.

B. *Provide glovebox design compatible with the process to be housed within the glovebox and allow for equipment to be installed and removed.*

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Perform the following analyses or define requirements for the following within the specification:

- *Conceptual sketch or drawing of the glovebox.*
- *Glovebox materials of construction*
- *Glovebox coating or lining requirements.*
- *Glovebox atmospheric requirements including inert atmosphere requirements, where applicable.*
- *Performance Category of glovebox to meet requirements of DOE-STD-1020 and DOE-STD-1021.*
- *Building or facility floor loading limitations.*
- *Glovebox operating and design pressure and temperature.*
- *Perform hazards analysis of glovebox and associated equipment. Determine necessary hazard mitigation systems and their associated management level. Include the type, range, location, action to be taken, and warning signals in the analysis. Characterize hazards to ensure glovebox adequacy.*
- *Include glovebox pressure control analysis and gas flow into or out of the glovebox.*
- *Need for ventilation filters. Determine type and size, and methods for replacement.*
- *Fire detection and suppression requirements. Include requirements, where necessary, for fire barriers, thermowells, heat sensors, automatic door closure, sprinklers or gas and fire department call out.*
- *Perform radiation shielding analysis, where appropriate. Determine and specify shielding type and thickness.*
- *Perform nuclear criticality analysis in accordance with LIR 402-300-01, where appropriate. Determine requirements for design of criticality prevention systems, allowable materials of construction, allowable configurations and geometry of items interfacing with materials at risk.*
- *Determine and provide requirements for toxicity, potency, pressurized vessels, or other special hazards.*

- *Determine and provide requirements for human factors, lighting, sound, reach, ventilation, and ambient temperature. Recommended parameters for some of these elements can be found in Section 5 of the AGS Guideline for Gloveboxes.*
- *Need for elements of machine and electrical guarding as required in 10 CFR 1910, Subpart S OSHA.*
- *Clearances on passageways, work areas, and surfaces. Maintain egress aisleways in accordance with NFPA 101, Code for Safety to Life from Fire in Buildings and Structures.*
- *Glovebox surface finish (inside and outside), as it affects cleanability and decontamination. Consider ergonomic impact from surface finish. Reflectivity from too highly polished surfaces can make working at gloveboxes for long periods of time uncomfortable.*
- *Design for decommissioning of gloveboxes and equipment inside.*
- *Perform safety/hazards analysis review as design progresses.*

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Define the supplier's design approach and provide requirements for submittal of design documents. Require that a systems design approach is followed such that internal process equipment is designed in conjunction with the glovebox so that system requirements are met. Provide the glovebox designer with complete internal process equipment arrangements prior to design of the glovebox, where possible. Consider design for maintainability, operability and safety during design of equipment directly associated with the glovebox, so that the glovebox can be designed appropriately.

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C. Approach

1. Perform designs in a phased approach including 30%, 60%, 90%, 100%, and As-Built, with LANL design reviews. The 90% submittal typically constitutes a complete design package for final review by LANL.

2. 30% Design: The 30% Design Phase includes a kick-off meeting, and development of design requirements (or design plan), drawings, and analyses. Provide documents in the 30% design phase sufficient to identify a preliminary layout of the glovebox depicting a preliminary glovebox support stand design and cutouts for windows, service panels, access panels, and gloveports. Indicate orthographic views of gloveboxes and overall glovebox size on drawings. Include the following:

   a. Partially completed assembly drawings showing arrangement of the glovebox structure, process equipment, connection locations for services, connection to other gloveboxes (if any), major glovebox components, and appurtenances.

   b. Preliminary seismic calculations.

   c. Drawing list or design plan for the completed design deliverable.

   d. Preliminary electrical, hydraulic/pneumatic, process, and instrumentation and controls (I&C) schematics.

3. 60% Design: The intent of the 60% design phase is to incorporate comments from the 30% design review and to further development of glovebox fabrication drawings. Include sufficient dimensioning to locate cutouts on the glovebox shell drawings. Depict views of the assembly without balloons and call-outs on the glovebox assembly drawings. Depict approximately 60% of the necessary dimensions for fabrication on the glovebox support stand drawings. Include the following:

    a. Partially completed assembly drawings with balloons and call-outs for major components including subassemblies.

    b. Control logic and wiring diagrams

    c. Hydraulic/pneumatic diagrams

    d. Piping and Instrumentation Diagrams (P&ID)

    e. Electrical wiring diagrams

    f. Documents showing continued progress from the 30% design as identified above.

4. 90% Design: The intent of the 90% design phase is to incorporate comments from the 60% design review and to complete the glovebox fabrication drawings and analyses. Complete drawings during the 90% design phase and include bills of materials, material callouts, dimensions, tolerances, and weld maps. Where required, provide seismic analyses of the glovebox support stands during 90% design phase. Include the following:

    a. Completed piping drawings.

    b. Completed electrical drawings (wiring diagrams, equipment arrangement, mounting details, conduit routing, components list, etc).

    c. Completed I&C drawings (logic diagrams, wiring diagrams, equipment arrangement, mounting details, conduit routing, components, list, etc).

    d. Completed process equipment details (arrangement, components, mounting details, etc.).

    e. Seismic analyses.

    f. Calculations.

    g. P&ID's.

    h. Hydraulic/pneumatic diagrams.

    i. Connection drawings, instructions, and anchorage details.

5. 100% Design: Incorporate LANL comments from the 90% design review and submit the drawings, analyses, and documentation identified above for final review and signature by LANL.

D. Document and Drawing Requirements

1. General

a. Maintain required records in accordance with the supplier's quality assurance program plan.

b. The use of 100% recycled paper, for record copies, is prohibited. Recycled content up to 25% is acceptable.

2. Engineering Documents

a. Develop documents in a legible fashion and in the English language. Develop engineering documents using a Microsoft Word. Provide calculations in a typewritten fashion or handwritten in pencil or black ink. The use of software packages like MathCAD and Microsoft Excel for development of calculations is acceptable. Request approval from LANL for use of any other software package not defined herein.

b. Validate and benchmark software used for calculations including engineering calculations, cost estimates, etc. in accordance with the supplier's quality assurance procedure requirements.

c. Document calculations with sufficient information on the purpose of the calculation, the design basis, assumptions, reference data, methods, results and conclusions to permit a technically qualified reviewer, including LANL, to determine their suitability for the intended purpose without recourse to the originator.

3. Drawings

a. Develop drawings in accordance with the LANL Drafting Manual and standard industrial machine design practices. Where the following requirements conflict with the LANL Drafting Manual, the Drafting Manual takes precedence. Include the following in glovebox drawing packages: assembly drawings, shell drawings (weldment) showing window openings, gloveport locations, and other openings with welded appurtenances; miscellaneous details; dimensioning; tolerancing; parts list; and weld maps.

i. Develop and produce drawings in accordance with ASME Y14-series documents.

ii. Provide dimensional tolerances in accordance with ASME Y14.5M.

iii. Provide surface texture symbols in accordance with ASME B46.1.

iv. Provide welding symbols in accordance with AWS A2.4.

v. Use symbols for piping and instrumentation in P&IDs in accordance with ISA standards.

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Define and specify project specific requirements for CAD programs and format of drawing delivery.
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vi. Produce drawings using a commercial Computer Aided Design/Drafting (CADD) application. Where requested by LANL, provide electronic files of design drawings in drawing exchange format (.dxf) or AutoCAD format (.dwg).

vii. Provide a drawing list of drawings generated with the glovebox drawing package. Update list as design progresses. Transmit list as title sheet of drawing package each time drawings are transmitted to LANL.

viii. Provide sufficient detail on drawings to show materials for components, weld details, dimensions, and tolerances. Do not show welds that join sheet material of the glovebox shell on the shell weldment drawings.

ix. Include manufacturer's name and applicable manufacturer's part or model numbers for vendor references, when included in bill of materials on drawings or included on data sheets.

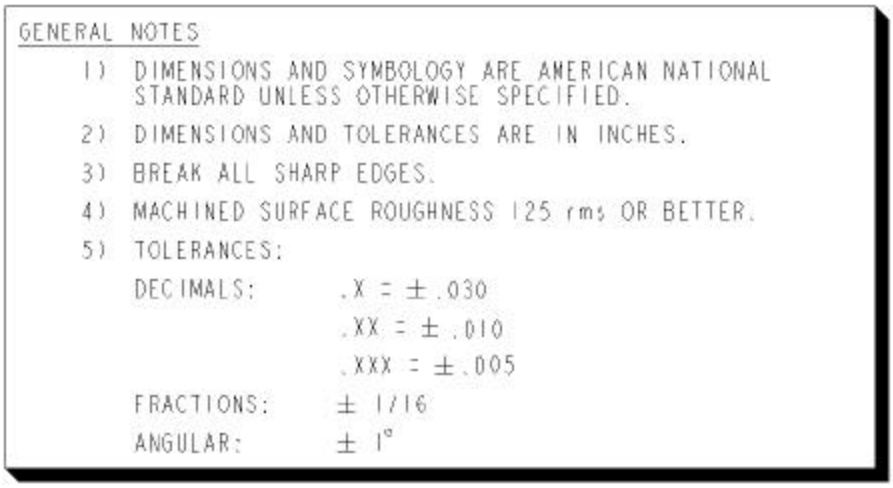
4. *Dimensioning*

a. *Dimension square and rectangular openings on glovebox shells to the edge of the opening, not to the center of the opening.*

b. *Use baseline dimensioning in preference to string dimensioning, to avoid tolerance build-up.*

5. Tolerances

a. Specify tolerances for gloveboxes and sheet metal fabrication on drawings in accordance with ASME Y14.5M and section 6.1.10 of the AGS Guideline for Gloveboxes, AGS-G001-1998. Modify tolerances for glovebox shell fabrication accordingly when designing especially large gloveboxes up to 100-feet in length. Use the following tolerance block where applicable for drawings of machined parts.



6. As-Built Drawings:

   a. Prepare as-built drawings to reflect the glovebox, as fabricated. Provide as-built drawings consisting of either CADD generated drawings or a redline markup of the fabrication drawings. Submit as-built drawings as part of the QA Document Package in accordance with Section 01300. Document the following in as-built drawings:

      x. Modifications and Deviations: Reflect modifications and deviations to the contract drawings that have been approved by LANL and subsequently implemented by the supplier. Do not note dimensional exceptions fabricated within the tolerances of the contract drawings.

      xi. Weld Locations on Weld Map: Indicate glovebox shell (primary confinement) weld locations on the weld map drawings. Do not depict other welds for stiffeners, stands, attachments, and outer skin. Do not provide numbering of welds and identification of welders and inspectors.

      xii. Material Identification: Identify material and heat number of each sheet (or piece – plate) of material used in the glovebox shell weldment on the weld maps.

7. *Dimensioning*

   a. *Dimension square and rectangular openings to the edge of the opening, not to the center of the opening.*

   b. *Use baseline dimensioning in preference to string dimensioning, to avoid tolerance build-up.*

8. Tolerances

a. Apply tolerances to drawings in accordance with ASME Y14.5M. A suggested tolerance block for machined part drawings is provided in § 1.6.E.3.b. Provide sheet metal fabrication tolerances for gloveboxes in accordance with Section 6.1.10 of AGS-G001-1998. Modify tolerances accordingly when designing especially large gloveboxes up to 100-feet in length.

E. General Principles and Performance Requirements

1. Design glovebox to provide a complete and permanent confinement of the equipment and processes within it under normal operating and incident conditions.

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Define the utilities that will interface with the glovebox and the necessary penetrations required in the glovebox. Also specify spare services and penetrations as required.

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2. Include provisions for necessary services and penetrations as required to ensure glovebox operability in the design.

3. Provide design of gloveboxes that accounts for methods of manufacture and inspection and testing.

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Define the negative operating static pressure range of the glovebox below.

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4. *Design gloveboxes to maintain a negative operating static pressure, between [negative 0.5 and negative 1.5] inches water gauge (w.g.) such that contaminant escape due to "pinhole type" leaks is minimized and so that transportation of contaminants out of the glovebox is prevented.*

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Define planned fluctuations of ventilation pressure and temperature. Also define the criteria for rigidity of the glovebox shell.

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5. Design the glovebox structure to be rigid enough to resist deflections caused by ventilation pressure differentials, temperature fluctuations or seismic loading, which may give rise to leaks. Also, design the glovebox structure for sufficient flexibility to allow joints to conform to one another during assembly, and to allow seals to function as the stresses built into the structure during fabrication relieve over the first few years of the glovebox's lifetime. Adequately support heavy equipment and shielding to eliminate adverse effects on gaskets and seals.

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Define the design pressures of the glovebox. Also determine and specify where required calculations to prove structural integrity of the glovebox to meet the design pressures.

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6. Design the glovebox so that structural integrity of the glovebox shell, including panels and windows, withstands [negative 7.5-inches] w.g. for vacuum and [7.5-inches] w.g. for pressure. Structural integrity is defined as not exceeding the yield strength of glovebox shell materials. Do not allow windows to crack or allow permanent deformation of the glovebox shell. Provide strengths of materials calculations to demonstrate the glovebox shell structural integrity. Perform strengths of materials utilizing a safety factor of 3 against yield strength.

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Define atmospheric requirements within the glovebox and the appropriate oxygen and moisture levels within inert atmospheres, where required. If nitrogen must be removed from the atmosphere, define requirements for level of nitrogen concentration as well.

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7. Gloveboxes are sometimes used to maintain an inert environment as well as to contain special nuclear materials. Design inert atmosphere gloveboxes to maintain atmosphere within the glovebox; mitigate the ingress of oxygen and moisture; and, prevent the migration of contaminant out of the glovebox. Design glovebox to maintain leak integrity of the primary confinement boundary and to maintain oxygen and moisture contents to less than [10, 100, 1000] parts per million by volume (ppmv).

8. Account for or limit the use of materials through which oxygen and moisture may permeate. Provide designs to mitigate permeation of oxygen and moisture through gloves, bagports, windows, service penetrations, and equipment interfaces.

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Determine and specify the maximum size and mass of gloveboxes and glovebox sections so that gloveboxes may be transported into the site and facility of operation.

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9. Modularize large gloveboxes to facilitate ease of manufacture and handling, transport to and access into plant at site, installation and decommissioning. Flange and join modules by bolting together and sealed using an established seal, normally a flat gasket. Maintain maximum size of each glovebox module to [XX-feet by XX-feet by XX-feet].

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Determine and specify the operations to be performed within the glovebox so that the supplier may design the glovebox adequately.

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10. Design gloveboxes so that simple maintenance and routine operating procedures may be performed through gloveports without undue hazards.

11. *Design the glovebox to minimize the potential for buildup of residual contaminants in gloveboxes that could result in chronic personnel radiation exposure by providing smooth finishes and easily decontaminated surfaces. Reduce the potential for accumulation of contaminants in gloveboxes by using a smooth finish throughout the glovebox; by rounding corners and floor-to-wall intersections; by having internal brackets attached to walls of the glovebox instead of the glovebox floor; and by eliminating crevices and abrupt intersections that may be created by intermittent welding on the interior of the glovebox. Design gloveboxes to allow for easy cleaning and decontamination.*

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Perform radiation shielding and criticality analyses where appropriate to determine and specify shielding and criticality requirements below. Perform radiation shielding analysis and ALARA analysis, where necessary, in accordance with LIR-402-700-01. Perform criticality analysis in accordance with LIR 402-300-01. If these analyses are not performed by LANL, specify performance of radiation shielding, ALARA and criticality analyses by the supplier. Provide the supplier requirements for radiation shielding thickness, shielding type, configuration, and source term where applicable. For criticality considerations, provide maximum dimensions and configurations of items containing fissile materials to prevent criticality. Common materials for shielding of gloveboxes include lead, water, water extended polymer, and extra thickness of stainless steel. Also consult applicable LIR's, DOE Orders, National Standards, and the AGS Guideline for Gloveboxes, AGS-G001-1998, for further information.

Consider that in some cases, where beta emitters are being handled, unshielded glovebox gloves will reduce the extremity dose rate. Consult LA-UR-99-3596, *Photon and Electron Shielding for Neptunium-237*, for further information.

Where feasible, specify maximum tank diameter, slab tank dimensions, minimum separations, etc. in the specification to properly define criticality in lieu of having the design vendor perform criticality analyses. Specify dimensional requirements in place of LIR references when a supplier other than LANL designs the glovebox.

For critical applications, specify shielding verification using a source. Specify shielding verification in Part 3 – Execution section of this specification.

****

F. Shielding and Criticality

1. Design shielding so that gaps between shielding are minimized. Stagger or overlap joints between lead sheets, for instance, to minimize "shine." Pack gaps between lead with lead wool.

2. *Minimize use of lead to mitigate concerns with the current environmental requirements over the disposal of mixed waste (such as material contaminated with lead). Design lead shielding to be covered with a cladding of stainless steel, where used.* Where feasible and approved by LANL, use additional thickness of stainless steel in place of lead for shielding.

3. Where possible, design gloveboxes so that the use of fluids, including oils, hydraulic fluids, and water inside the primary confinement containing fissile materials is limited.

4. *When water is used for neutron shielding, design the water wall cavity to be hydraulically leak-tight and to have the necessary structural integrity to support the hydrostatic loads*. Ensure that the loss of water shielding due to pump down, draining, or establishing an inadvertent siphon is eliminated. Provide provisions for normal water shielding expansion, contraction, and level verification. Also provide couplings for filling and draining. Provide couplings with plugs.

5. Where gamma shielding is used in water wall gloveboxes, attach the lead to the outer shell.

6. Design glovebox parts out of metals wherever practical, due to their inherent ability to withstand radiation. Where this is not possible, Attachment 2 shows materials of good and poor stability; avoid use of materials with poor stability. Attachment 2 is based on accelerated irradiation (Dose D measured in Greys, Gy) at ambient-temperature in air and should only be taken as a guide. The values of absorbed dose are for negligible damage. The effect of radiation on individual material properties varies and the life of a particular component depends upon the limiting property. For critical components, carry out accelerated tests to measure the effect of radiation on the limiting property.

****

Determine and specify the applicable performance category (PC) of the glovebox. Where applicable specify floor response spectra, peak accelerations, damping ratios, etc. necessary for the supplier to perform seismic analyses. Follow the LANL Facility Engineering Manual Structural chapter. Determine and specify the performance requirements of the glovebox including the performance and leak integrity of the glovebox during and after a design basis earthquake (DBE). Also determine whether seismic analyses must be performed on the glovebox and to what extent.

****

G. Seismic Design

1. Depending upon the quantity and characteristics of the materials being contained, design gloveboxes to withstand a design basis earthquake (DBE).

2. Refer to Section 13085 for additional seismic protection requirements.

3. The performance category of the glovebox is [PC-2, PC-3].

4. Perform seismic analysis of the glovebox in accordance with the applicable performance category requirements and as stated in DOE-STD-1020 and DOE-STD-1021 and LANL Engineering Manual, Chapter 5, Structural.

5. In the seismic analysis, determine demand to capacity (D/C) ratios for the glovebox shell, support stand members, and the glovebox floor anchoring.

6. If the mass and center of mass of the equipment inside of the glovebox is unknown, increase the total calculated mass of the glovebox shell assembly by 25% to account for equipment and future additions to the glovebox internals.

7. Account for an accidental offsetting of the center-of-mass by 5% of the plan dimensions from the calculated location.

8. Perform dynamic seismic analyses for PC-3 gloveboxes using commercial finite-element-analysis software that has been benchmarked and proven by the supplier. Examples of software include SAP 2000 and RISA-3D.

****

Determine and specify the human factors requirements and address the issues below. Where considered necessary by the author, specify the development of a human factors analysis for the glovebox. Consider that a human factors analysis requires knowledge of design of the equipment inside the glovebox. Provide details of equipment inside the glovebox, where applicable, so that the supplier may provide ergonomic design of the glovebox.

****

H. Anthropometrics

1. Ensure that any part of the equipment or process within the glovebox requiring manual access is within effective glove reach.

2. Optimize design of glovebox to account for the following:

   a. Strength of operator.

   b. Height and reach capability of operator.

   c. The plane in which force must be exerted with relation to the rest of the body.

   d. Direction of force, (i.e. push or pull).

   e. Shape of the weight or control to be operated.

   f. Length of time of exertion.

   g. Dexterity of the operator.

3. *Design gloveboxes to fit a user population raging from the 5th percentile female through the 95th percentile male, unless otherwise specified. Where specific dimensions are cited in the following sections, it represents the limiting human design conditions.*

4. *Design gloveboxes such that the majority of glovebox tasks are performed within a normal work envelope, 11 to 13 inches, with a maximum of 18 to 20 inches.*

5. *Provide glovebox designs with dimensions for the front face of glovebox to the rear interior of glovebox, optimal dimensions for maximum accessibility as follows:*

   a. *Single-sided access: Nominal 24 inches, maximum 26-inches (range from 18 to 26 inches), (5th female percentile).*

   b. *Double-sided access: Nominal 48 inches, maximum 52 inches (range from 36 to 52 inches), (5th percentile female).*

6. Follow OSHA requirements set forth in 10 CFR 1910.120 and ANSI/IEEE 1023 Guide for the Application of Human Factors Engineering.

****
Provide the supplier with a conceptual sketch of the glovebox shell that will serve as a baseline for the supplier's design.

****

I. Glovebox Shell

1. *The inner wall/shell of each glovebox requires regular routine cleaning to remove operational deposit. Make inner faces accessible within gloveport range and, as much as possible, unobstructed. Upper surfaces may be accessed using cleaning tools at the discretion of LANL.*

2. If glovebox stiffening is required, weld stiffeners externally to the glovebox, where practical. Provide stiffeners as plate, strip or sheet welded normal to the surface of the glovebox. Mechanical tubing stiffeners may also be used in lieu of plate strip or strip, where additional stiffness is required. Do not use mechanical tubing inside the glovebox without prior permission from LANL. Provide stiffeners of the same grade of stainless steel as the shell material. Requirements for stiffening materials including ASTM specifications are provided in the materials section of this specification.

3. Provide clear areas near gloveports for mounting of arm and hand frisking radiation probes to facilitate hand and arm frisking immediately after removal from glovebox gloves.

****
Specify alternative corner radii for larger gloveboxes.

****

4. *Corners*

   a. *Provide corners of gloveboxes with a minimum inside radius of 5/8-inch. For larger gloveboxes and lined gloveboxes, the radius may be larger. Provide corners of lined gloveboxes with 2-inch radius to assure proper application of the lining.*

****
Determine and specify the grade, type and thickness of stainless steel used in the glovebox design.

****

5. Material

   a. *Design glovebox shells using 300-series stainless steel of type 304, 304L, 316, or 316L. Provide designs with stainless steel sheet material of 7 gauge, cold rolled, annealed, and pickled per ASTM A240 and ASTM A480, with a 2B mill finish.*

b. *Use plate stock of the same grade of stainless steel, when thicker material is required, such as for floors supporting heavy objects. Provide a continuous and contiguous transition between plate stock and sheet on the inner surfaces of the shell so that crevices within the glovebox interior are avoided.*

****

Determine and specify the number and type of hoods needed. Define limiting airflow within the facility in which the hood will be installed. If possible, provide a conceptual sketch of the hood that will serve as the baseline for design. Determine whether the hood will need to be closed. Specify the type of system to use to bypass airflow around the hood or through the hood when the hood is closed. This can be achieved through a filtered bypass duct next to the glovebox or by providing another filtered opening on the hood so that air may flow through the glovebox when the glovebox is closed. Airflow may also be reduced regulated using variable airflow venturi style dampers, such as those manufactured by Phoenix Controls, provided in the facility ductwork. If airflow must be shut-off a butterfly valve with edge seals will be required. If appropriate, define appropriate leak integrity for the door that provides the confinement.

****

J. Hoods

1. Design hoods to maintain confinement of hazardous materials and particulate through airflow. Design to maintain air flow velocities across hood openings at 125 ± 25 fpm in accordance with DOE Order 6430.1A, Division 11, the American Conference of Governmental Industrial Hygienists (ACGIH), and the American Glovebox Society Guideline for Gloveboxes.

2. Minimize the number of openings into the hood to maintain appropriate flow velocities and to minimize airflow.

3. Design the hood so that it may be closed providing a confinement of appropriate leak integrity.

4. Provide clear areas near opening for mounting of arm and hand frisking radiation probes to facilitate hand and arm frisking immediately after removal from glovebox gloves.

****

Determine and specify the material used for the support stand to meet LANL facility requirements. Determine and specify other support stand requirements such as height of stand to mate the glovebox with other gloveboxes, adjustability of support stand height, field location requirements of anchoring, etc.

****

K. Support Stands

1. Support gloveboxes by a fabricated support stand, bolted to the glovebox base. Design the support stand for anchoring the glovebox to the facility floor. Fabricate the support stand from stainless steel or carbon steel structural shapes. Where carbon steel is used, provide a decontaminable coating on to the steel. Refer to the painting section of this specification.

2. Refer to Section 05120 and to Part 3 of this specification for requirements of structural steel.

3. Design glovebox support stands in accordance with LANL Engineering Manual, Chapter 5, Structural, and to meet appropriate performance category (PC) requirements in accordance with DOE-STD-1020 and DOE-STD-1021.

4. Where practical, provide a support stand design that allows for vertical adjustment at installation. Shimming of glovebox support stands with shims greater than 1/4-inch thickness is prohibited. Avoid design of glovebox support stands that require field welding.

5. Where a support stand is not required, design the glovebox for anchoring directly to the facility floor.

6. Where determined by the seismic analysis to be necessary, provide corner gussets or diagonal braces with the support stand. Design diagonal braces for bolted attachment to the support stand upright members.

7. When feasible, include a horizontal bar in the stand that can be used as a foot rest.

****

Determine and specify the number and type of airlocks required. Determine and specify minimum size of the airlock, airlock door types, the necessity for a slide tray, materials of construction, and configuration of airlocks. At a minimum, specify the maximum size and weight of materials or items to be passed through the airlock. Also specify the number and types of penetrations on the airlock for purging operations. Provide a hood to enclose the airlock when using the airlock to remove items from primary confinement. Potentially contaminated items should be withdrawn into a hood where they can be assayed, bagged, etc.

****

L. Airlocks

1. *Size airlocks based upon the size of the items to be passed through them. Do not provide gloveports on airlock confinements.*

2. *Where required, provide a slide tray within the airlock for easier transfer of materials and items.*

3. *Provide administrative or designed controls so that both doors cannot be opened at the same time.*

4. Provide evacuate/purge capability and connections on the airlock to exchange the airlock atmosphere.

****

Determine and specify either the equipment and operations inside the glovebox, or the prescribed gloveport placement so that gloveports may be located effectively. Also specify the size and type of gloveports. Specify accessories to gloveports including plugs and covers. Consider providing multi-adjustable footstools for operators.

****

M. Gloveports and Gloveport Placement

1. Design gloveboxes for the use of push-through gloveports from Central Research Laboratories (CRL) of the round or oval shape for gloveboxes. Provide gloveports welded into the glovebox shell or clamped into windows. Note that o-ring seal material for the rings and bungs will require selection based on the glovebox environment.

2. Provide gloveports of the rolled and welded type or CRL push-through type for hoods.

3. *Locate gloveports to facilitate replacement of gloves without breaching confinement.*

4. *Use oval-shaped or large-diameter gloveports when increased functional reach capability is required*

5. *Place centerline height of primary, working gloveports between 48-inches and 52-inches in height from finished floor to centerline of gloveport.*

6. *Provide spacing between horizontal centerlines of a working pair of gloveports at nominally 16.5-inches (range between 15 and 18-inches).*

7. *For reach capability, maintain horizontal centerline of nearest row of gloveports to glovebox top/bottom at 18-inches.*

****

Determine and specify the window types, viewing pane material, size and placement. If size and placement is not provided, provide a description of equipment and operations inside the glovebox so that windows may be sized and placed appropriately by the supplier. Specify placement of gloveports in windows. Determine and specify whether shielding on windows is required. Specify thickness and materials of shielding and connection of shielding glass to the window frame. Lexan® may be used on tritium gloveboxes; however, safety glass is recommended due to its low combustible loading.

****

N. Windows

1. Provide windows of either the zipper window style or the clamp-strip style. Window details for both styles are provided in the Attachment 1.

2. Where greater visibility is required, construct the glovebox walls so that large windows may be placed on the operational surfaces of the glovebox. Provide gloveports mounted in the windows.

3. Use clamp-strip style windows in gloveboxes containing plutonium or tritium. Use C-channel gaskets as shown in the Attachment 1 drawings.

4. Provide fire shields inside the glovebox on zipper window gasket assemblies.

5. Provide strength of materials calculations for glass thickness based upon design pressure of glovebox. Perform strengths of materials utilizing a safety factor of 3 against yield strength.

6. Provide shielding glass where additional radiation shielding is required. Provide shielding windows consisting of two frames with one frame holding glass and providing confinement and the other frame holding shielding glass and providing shielding.

7. *Select materials based on transparency, and resistance to fire, abrasion, corrosion, puncturing,* tritium exchange, and water vapor permeation *as necessary.*

8. *Maximize size to optimize visibility, with the goal of minimizing blind spots.*

9. *Provide horizontal centerline placement at eye level: 61 to 63 inches above finish floor for standing operations, centered above pair of gloveports. The 5th percentile female eye height is 55.5-inches, and the 95th percentile male eye height is 68.2-inches.*

10. *Use a sloping glovebox face, 10° to 15° maximum, where feasible, to reduce glare and potential blind spots and to enhance vision and working posture.*

****

Determine and specify lighting requirements in footcandles (fc) or lumens for the glovebox. Also specify whether the supplier will provide lights and the type of lights required.

****

O. *Lighting*

1. *When using non-fluorescent lighting, provide methods to adjust lighting levels both inside and outside the glovebox to minimize glare. Design with approximately 100 footcandles (fc) at the work surface.*

2. *Provide luminaries with baffles to diffuse light, and ensure light tube is not directly visible to a user's eye.*

****

Determine and specify lifting requirements including any LANL specific hoisting and rigging requirements to which the glovebox must be designed.

****

P. Lifting Points – Glovebox Structure

1. Incorporate lifting features, (i.e. bolts or lugs) into the glovebox design as required. Design and position lifting features to prevent distortion of the glovebox. Design lifting features to accept lifting by forklift and crane and mark features appropriately.

2. Where lifting eyes are not provided as a feature of the design, indicate suitable lifting points on the main glovebox framework. If the framework is not adequate to take the load, provide external strong-backs or other bracing devices.

3. Design gloveboxes so that they can be lifted from below the support frame, which is bolted to the glovebox shell.

Q. Weld Studs and Fasteners

1. Provide sufficient clearance for box end wrenches or socket wrenches where hexagon headed bolts and acorn nuts are used, per ASME B18.2.1. Minimize the range of bolt sizes in the design of the glovebox (1/4-inch to 3/4-inch) in order to limit the number of tools required. Other cap screw and bolt sizes may be used as approved by LANL.

2. Position fasteners inside of gloveboxes for ease of access via gloveports and visibility through glovebox windows. Provide sufficient space manipulate tools for the loosening/tightening of fasteners.

3. Do not penetrate the glovebox shell with fasteners since leakage can occur past the screw threads. Where items must be attached to the glovebox shell such as access panels, services panels, windows, etc., provide pattern of weld studs of appropriate size and spacing around a shell opening to allow attachment and appropriate sealing of the component. Blind tapped holes on the outside of the glovebox shell are also allowed when there is sufficient shell thickness to allow for proper screw thread engagement.

4. Do not use screws or any other fastener inside a glovebox that would require use of a tool such as a screwdriver or Allen wrench that could puncture a glove.

5. Where feasible, provide designed fastened joints such that screw thread engagement length is at least 1-1/2 times the diameter of the screw.

6. Avoid the use of grub screws, knurled or slotted head fasteners, spiral pins, circlips, split pins, and locking wire unless specifically approved by LANL.

7. Do not use high tensile steel fasteners in the construction of lifting equipment.

8. Select materials for stainless steel threaded components carefully to minimize the possibility of galling and seizure. For this reason, do not use non-approved threaded components in place of specified requirements. When selecting dissimilar materials to prevent such occurrence, in general, provide the nut or one material of type 304L stainless steel and the mating material of ferritic stainless steel.

9. Apply anti-seize compound to mating stainless steel threads prior to assembly.

****

Determine and specify the types of filter housings required, including materials of construction, configuration and size. Gloveboxes where radioactive particles may be suspended in the atmosphere require HEPA filters at the point of exhaust from the glovebox. If there is a supply directly to the glovebox, it requires a HEPA filter to prevent backflow of contamination. Normally tritium boxes have gaseous radioactivity where HEPA filters do not provide protection. Occasionally, tritium applications do involve dusty tritium contaminated material. In those cases a filter will be needed.

****

R. Ventilation and Filter Housings

1. For once through air-ventilated gloveboxes, design the steady state airflow so that air will be drawn through the largest credible rupture (open gloveport, open bagport, etc) with a velocity of 125 fpm. Design to achieve open port flow without action by a control valve

2. Provide glovebox inlet filter housings of an in-line type and fabricated from stainless steel. Provide plywood filter housings for inlet filters with prior approval from LANL.

3. Size outlet filters and filter housings for gloveboxes for appropriate flow and pressure drop. Utilize the Industrial Ventilation manual from the American Conference of Governmental Hygienists (ACGIH).

4. Design outlet filter housings for fabrication from 300-series stainless steel. Provide filter housings of the push-through type for safer change-out of filters. Refer to Attachment 1 for design details of push-through filter housings.

****

Determine and specify the number, types, and configuration of shell penetrations and interfacing utilities.

****

S. Shell Penetrations and Utilities

1. Where feasible, locate ventilation inlet and outlet penetrations in diametrically opposite corners of the glovebox to allow for proper flushing of the glovebox atmosphere. Provide HEPA filtration for ventilation inlet and outlet penetrations.

2. Where practical, locate service penetrations for utilities on service panels that allow for easier modifications to the glovebox penetrations in the future.

3. At a minimum, provide shell penetrations for the following utilities: ventilation inlet, ventilation outlet, magnehelic / photohelic connections,

4. Provide magnehelic / photohelic located on the glovebox shell so that it is possible for operators to view the gauges without removing their hands from the gloves. Provide one magnehelic / photohelic gauge above or between the main viewing windows, one for every two operator stations.

5. Provide a nominal amount of spare connections in service panels for future use.

6. Where practical, pipe services inside and outside of gloveboxes in stainless steel. For connections where rigid pipe work is not practical, provide alternative connection systems with approval by LANL.

7. Do not provide connections / fastenings of the hose clamp type. Where feasible, use quick release type, self-sealing couplings with flexible connections inside of gloveboxes. Ensure that the glovebox design provides sufficient access to make / break these types of connections and that it does not pose a hazard to operators.

8. Refer to Section 15215 for requirements of compression fittings for copper and stainless steel tubing. Use face-seal fittings (o-ring or metal gasket) for tubing in critical leak tight applications.

9. Run services in such a way that they can be accessed via gloveports if replacement becomes necessary.

10. Run services around the perimeter of the glovebox so that they do not interfere with the requirements for routine access to the glovebox.

11. Use small-bore pipe supports integral with the glovebox shell, with prior approval from LANL. Do not use self-adhesive clips.

12. Fit services run inside gloveboxes with durable and easily readable fixed labels which do not have sharp corners, remain fixed in the original positions and do not become unreadable as a result of time or radiation. Provide mechanical identification of penetrations in accordance with Section 15190.

13. Unless otherwise specified, do not route service pipes through the glovebox base, as this inhibits cleaning and decontamination of the base.

****

Determine and specify the number, types, size and configuration of access and service panels. Panel removal must not be used as a routine operation. Panels will only be removed as a last resort, perhaps only once in the lifetime of the plant.

****

T. Access and Service Panels

1. Equip gloveboxes with removable access panels to facilitate equipment installation and/or removal. Where fitted, provide panels capable of maintaining glovebox integrity using a gasket seal.

****

Determine and specify the number, types, size and configuration of material transfer devices for gloveboxes. Use input sphincters for input of devices only. Use double-door transfer systems for materials transfer operations between confinements. Double-door transfer systems provide a safe means to transfer materials without contamination of the working environment. Double-door transfer systems are also known as Alpha-Beta Transfer Doors, Rapid Transfer Ports, etc.

****

U. Material Transfer Devices

1. Provide material transfer devices including [bagports, double-door transfer systems, airlocks, input sphincter, introductory tubes]. Attachment 1 of this section provides design details of some of these material transfer systems.

2. Place bagports on the base of the glovebox or on the side. Where bagports are used on inert atmosphere gloveboxes with stringent purity requirements, provide a cover on the inside and outside surface of the bagport to mitigate migration of oxygen and moisture through the attached bag.

3. Provide bagports with rings or indentations to allow for easier placement of attachment clamps or rubber rings when performing bagport operations.

****

Determine and specify the type, thickness and configuration of glovebox linings or coatings where needed. *Protective coatings and linings have been used successfully under specific conditions in gloveboxes for many years. The chemical structure of some materials provides the required resistance to the environments typically found in nuclear and chemical processing. Evaluate coating or lining materials for resistance to radiation, chlorides and chemical before use. Coating and linings can be applied using various techniques. They provide a cost-effective solution to process problems. Some coatings may contain solvents or processing aids that could interfere with long-term performance. Evaluate each coating system carefully. For specific information about the testing, installation and quality control of linings, refer to the AGS Guideline for Gloveboxes, AGS-G001-1998, Section 7.*

****

V. Glovebox Linings

****

Determine and specify the type of pressure relief device to be used with the glovebox. If the supplier is not providing the pressure relief device, provide appropriate specifications for interface of pressure relief devices such as bubblers or pressure control valves. Define the maximum operating pressure and relief pressure below. Consider the use of either bubblers or pressure control valves during the development of hazard analyses since each system has inherent hazards.

****

W. Pressure Relief Devices

1. Refer to Section TBD for requirements of pressure relief devices.

2. Provide over-pressure and under-pressure relief on gloveboxes using bubblers or pressure control valves.

****

Determine and specify other glovebox appurtenances specific project requirements. Prior to specifying reciprocating shaft feedthroughs, consider the possibility of contaminant transport out of the glovebox. Provide information regarding the equipment inside of the glovebox so that shaft feedthroughs, guards, and lifting equipment may be employed in the design.

Evaluate the adverse effects of glovebox atmospheres including inert atmospheres on component operation. Consider the potential for increased failure, maintenance and replacement problems on glovebox components in the design of the glovebox shell.

****

X. Other Glovebox Appurtenances

1. Shaft Feedthroughs

a. Where rotating shafts pass through the glovebox shell, use a cartridge type seal. Utilize magnetic coupling systems in lieu of shaft penetrations where technically feasible.

b. Provide a cartridge design that consists of the bearings and seals in a common housing, fixed to the glovebox shell, enabling defective seals / bearings to be replaced without losing confinement, (i.e. the new cartridge pushes the old one into the glovebox).

2. Guards

a. Guard equipment inside of gloveboxes with moving parts or any other mechanical or electrical equipment of potential risk to operations or maintenance staff in such a manner to satisfy Occupational Safety and Health Administration (OSHA) requirements.

b. Provide guarding of equipment within a glovebox so that equipment is still maintainable. Provide guards that are easily removable and attached by fasteners.

c. Determine and eliminate traps created by moving parts, or by actuation of levers, so that safe operations can be performed. Guard access to dangerous parts of moving machinery in compliance with the guidelines set out under 10 CFR 1910 Subpart 0.

d. Provide lockout / isolation points to de-energize moving machinery during operation or when maintenance is required to be performed (see OSHA lockout / tagout standard 10 CFR Part 1910.145).

3. Lifting Equipment

a. Where lifting equipment is required, provide the equipment in accordance with the following requirements, CMAA-70, ASME B30.16, ASME B30.2.1, ASME HST-4M, and ASME HST-3M.

b. Where lifting equipment inside of the glovebox is performing "critical" lifting operations, apply ASME NOG-1 for design, manufacture, installation and operation of the lifting equipment.

c. Design lifting equipment so that statutory examinations can be performed.

d. Design lifting equipment so that replacement/servicing of glovebox equipment (including the lifting equipment itself) can be performed safely.

e. Provide lifting equipment 'light' enough to be manipulated into place by hand via glove ports.

f. Provide protection of equipment below the lifting area from dislodged/dropped loads.

Y. Heat Load Management

1. Provide means to limit heat loads within gloveboxes in a criticality-safe fashion. Locate furnaces and heat sources outside of gloveboxes so that cooling water is not introduced inside the primary confinement. Utilize cooling wells where feasible.

1.8 LANL FURNISHED AND INSTALLED EQUIPMENT

A. Refer to Section 01015.

1.9 SUBMITTALS

A. Provide reference to LANL Contract Number, Glovebox Number, Glovebox Title, and Drawing Number on correspondence.

B. Provide submittals listed in Attachment 5 and in accordance with the requirements of Section 01300.

****

Determine whether the kick-off meeting is required and the appropriate time for the kick-off meeting.

****

1.10 KICK-OFF MEETING

A. Hold a half-day kick-off meeting at Los Alamos, NM within 10 working days after award of the contract. The kick-off meeting may be waived at the discretion of LANL. Provide technical documentation required for submittal at the kick-off meeting conference even if a kick-off meeting is not held. Review the following at the kick-off meeting:

1. Contract document provisions.
2. Design requirements.
3. Technical specifications.
4. Contract drawings.
5. Fabrication schedule.
6. Supplier's lower tier services plan.
7. Supplier's QA manual (design and fabrication).
8. Required procedures.
9. Welding and NDE Personnel List.
10. Philosophy of shop traveler.

****

Determine and specify schedule requirements including required delivery date if critical.

****

1.11 SCHEDULE

A. Provide a design and fabrication schedule showing design steps, design submittal milestones, review periods, fabrication steps, hold points, tests, and inspections. Include milestones associated with the design phases, 30%, 60%, 90%, and 100%. Provide fabrication schedule to LANL, for approval, at the kick-off meeting.

B. Indicate design phases and review periods. Plan on a 10 working day period for each LANL review cycle.

C. Provide a revised fabrication schedule for LANL approval within seven (7) working days of a modification to the contract document, which revises the required delivery date, or when other approved LANL changes otherwise change a schedule assembly step hold point, test, or inspection.

D. Provide seven (7) working days advance notice of a hold point activity requiring LANL witness or inspection.

****

Determine whether a shop traveler is required for submittal with the fabrication of the glovebox.

****

1.12 SHOP TRAVELER

A. Use a shop traveler system and the contract drawings to transform the technical requirements of this specification into specific work instructions, which indicate the fabrication and inspection sequence and identify hold points.

B. Provide a shop traveler procedure. Include in the procedure a description of the preparation, use, and monitoring of the shop traveler. Also include in-process tracking of items, processes, hold points, and inspections. Submit for approval, the shop traveler procedure prior to fabrication. Provide the shop traveler form as an attachment to the shop traveler procedure.

C. After work is finished, submit the completed shop traveler form as part of the QA Document Package in accordance with Section 01300.

****

Determine and specify any additional design or fabrication hold points required on a project-by-project basis.

****

1.13 FABRICATION HOLD POINTS

A. Hold points are required during the fabrication process to allow inspection, verification, or approval by LANL before the supplier does further work. Identify hold points on the shop traveler and make provision for LANL signoff. The hold points are:

1. Weld Fit-up Inspection

2. Lead Fit-up Inspection (Lead shielded gloveboxes only)

3. Shop Acceptance Testing and Inspection

B. For hold points requiring witness or inspection at the supplier's facility, provide seven (7) working days advance written notification to LANL so that a LANL representative may be present at the supplier's shop to witness the activity. At LANL's discretion, photographic records of the fit-ups may be substituted for physical inspections.

****

The following quality assurance requirements are consistent with design and fabrication of a ML-1 and ML-2 glovebox. Where other quality assurance and quality control requirements are needed, modify the following section accordingly. For instance, the supplier may also apply a QA program in accordance with basic requirements of 10 CFR 830.120. Add requirements for QA Programs compliant with 10 CFR 830.120 to the specification as necessary.

****

1.14 QUALITY ASSURANCE/QUALITY CONTROL

A. As used in this document, QA is intended to control a combination of design, materials, preparation, fabrication, inspection, testing, cleaning, packaging, and shipping to be done to ensure the protection of an acceptable finished product. Maintain a QA program in accordance with certain Basic Requirements of ASME NQA-1-1997, QA Program Requirements for Nuclear Facilities.

B. QA Manual (Design): Submit an uncontrolled copy of the supplier's QA Manual for approval. Address the following NQA-1 Basic Requirements in the QA Manual:

1. Basic Requirement 1: Organization

2. Basic Requirement 2: Quality Assurance Program

3. Basic Requirement 3: Design Control

4. Basic Requirement 4: Procurement Document Control

5. Basic Requirement 5: Instructions

6. Basic Requirement 6: Document Control

7. Basic Requirement 7: Control of Purchased Items and Services

8. Basic Requirement 15: Control of Nonconforming Items

9. Basic Requirement 16: Corrective Action

10. Basic Requirement 17: Quality Assurance Records

11. Basic Requirement 18: Audits

C. Comply with the information contained in the supplier's drawings and in related specification sections, referenced in the contract, during detail design of gloveboxes.

D. Upon completion of the detailed design, as a minimum, perform the mechanical design checks as indicated in the following sections, prior to issue of information for acceptance.

1. Check assemblies to ensure that parts function correctly under defined conditions, that they have the correct relative proportions, that the general design is correct in the matters of strength, rigidity, bearing areas, appearance, convenience of assembly and that there are not interferences.

2. Check dimensions to see that they are correct. In checking dimensions, note particularly the following points:

    a. See that figures are correctly depicted and that they will print clearly.

    b. That the overall dimensions are given.

    c. That witness lines lead to the correct part of the drawings.

    d. Proper allowances are made for fits.

    e. Tolerances are correctly given where necessary.

    f. That dimensions are compatible with the corresponding dimensions of adjacent parts.

    g. Compliance with ASME Y14-series documents.

3. In addition, address the functionality of the detailed design and confirm that the criteria set out in Attachment 3 are met.

E. QA Manual (Fabrication): Submit an uncontrolled copy of the supplier's QA Manual for fabrication at the kick-off meeting for approval. Address the following NQA-1-1997, Basic Requirements in the QA Manual:

1. Basic Requirement 1: Organization

2. Basic Requirement 5: Instructions

3. Basic Requirement 6: Document Control

4. Basic Requirement 7: Control of Purchased Items and Services

5. Basic Requirement 8: Identification and Control of Items

6. Basic Requirement 9: Control of Processes

7. Basic Requirement 10: Inspection

8. Basic Requirement 11: Test Control

9. Basic Requirement 12: Control of Measuring and Test Equipment

10. Basic Requirement 13: Handling, Storage, and Shipping

11. Basic Requirement 14: Inspection, Test, and Operating Status

12. Basic Requirement 16: Corrective Action

F. It is acceptable to reference the procedures in the following sections as a part of the Quality Assurance program.

G. Fabrication and Quality Control (QC) Procedures: The list of procedures to be followed and their submittal schedule is contained in Section 01300. LANL in cases may waive submittal, where procedures have previously been evaluated. Maintain a list of quality procedures, including the revision number or date of approval.

H. Personnel Certifications: Ensure that supplier personnel assigned to glovebox fabrication including welding, assembly, testing, and inspections are fully qualified to perform their respective job functions. Section 01300 contains the list of required personnel certifications, and their schedule for submittal.

I. Test Reports: Ensure that tests performed in support of the glovebox fabrication, welding, assembly, testing, and inspection are fully documented. Section 01300 contains the list of test reports, and their schedule for submittal.

J. Material Certifications: Provide material certifications including legible copies of mill test reports indicating chemical analysis, physical test data, and heat number. Section 01300 contains the list of material certifications, and their schedule for submittal.

K. As-Built Drawings: Submit as-built drawings as described in § 1.7.E.6 of this specification, to reflect modifications or deviations to the contract drawings. In addition, use these drawings to indicate weld locations and material identification and to document the dimensional verification performed by the supplier.

L. QA Document Package: Submit documents identified in this specification as a part of the QA Document Package. Complete three bound or stapled document packages containing these documents required “with shipment” in accordance with Section 01300. Mail one package to LANL and provide the other two packages with the glovebox shipping crate.

1.15 MATERIAL CONTROL

A. Material Control Procedure

1. Submit to LANL, for approval, a material control procedure to be used in the execution of the work. Describe the control methods and traceability documentation in the procedure used by the supplier to handle and monitor the use of controlled materials, such as stainless steel and welding filler rod.

2. Address procurement controls, segregation of materials, and traceability of materials from receipt at the shop through processing and final assembly in the procedure. Submit this procedure to LANL for engineering review, comment, and approval, prior to fabrication.

B. Heat Numbers: Note heat numbers on weld maps using low-chloride content marking pens on each piece part and the material identifications transferred to the as-built drawings as described in § 1.7.E.6.

1.16 EXCEPTIONS, DEVIATIONS, AND CONFLICTS

A. Submit a written request to LANL for any proposed technical changes, exceptions, and/or deviations to this specification or the contract drawings. Submit proposed changes that affect cost or schedule in accordance with the provisions of the contract document.

B. Supplier Deviation Disposition Request (SDDR): Provide proposed change information using the SDDR form provided as Attachment 4. Consecutively number SDDR's and submit by facsimile for expediency with a record copy to follow by mail. Submit one (1) copy the LANL Contract Administrator and a second to the LANL Contract Administrator's Technical Representative. Do not implement proposed changes, exceptions, or deviations until the LANL Contract Administrator provides written approval by means of the SDDR form.

C. Conflicts: Notify LANL in the event of conflicts amongst the specifications, drawings, and/or the manufacturer's recommended processes or instructions. Provide notification of a conflict immediately following its discovery. Provide notification in written form, or via phone call followed by facsimile.

****

Evaluate and determine whether proposed substitutions for "or equal" products are adequate for the intended purpose.

****

D. Substitutions

1. Request approval for substitutions by submitting an SDDR form, where this specification or the contract drawings contain a "brand name or equal" description. Submit one (1) copy to the LANL Contract Administrator and a second to the LANL Contract Administrator's Technical Representative.

2. If the supplier proposes to provide an equal to the listed brand names, the evaluation and the determination as to the quality of the proposed product will be the decision of LANL and will be based on information furnished by the supplier.

3. There will be no responsibility by LANL for locating or securing any information to evaluate and determine the equality of any proposed product. Therefore, ensure that sufficient information and descriptive material are provided such as cuts, illustrations, drawings, or other information to establish clearly and precisely what product the supplier is proposing and demonstrate that the product offered meets the requirements of this specification.

1.17 PACKAGING PREPARATION

A. Do not perform packaging and shipping of gloveboxes until shop acceptance testing and inspection have been performed and the results approved by LANL. Prepare and package gloveboxes and associated components to prevent damage during shipping and handling. Use particular care to ensure that the surface finishes, cleanliness, dimensional stability, and overall integrity of the gloveboxes achieved during fabrication are not affected during shipment.

B. Install windows loosely on the glovebox or ship separately. Electrical connector installation is optional, depending upon vulnerability. Seal glovebox openings with temporary covers or other protection to exclude dirt and prevent damage to openings of fittings or sealing surfaces of gasketed openings. Protect mating surfaces with clean plywood or cardboard covers. Use tape consisting of low chloride (250 ppm) content.

C. If glovebox is fabricated at an elevation different from the elevation indicated in the site conditions section of this specification, provide for a means of pressure relief in the glovebox during shipping. An open service penetration on the glovebox will provide adequate means of pressure relief. Do not seal glovebox during shipping.

1.18 PACKAGING

A. Packaging Procedure: Submit a packaging procedure. This procedure describes the methods, material control, and inspections to be used by the supplier to perform glovebox packaging for shipment. The procedure addresses the covering of glovebox openings, pallet and crate construction, protection of the glovebox sealing surfaces, and marking of the crate. Submit this packaging procedure for approval prior to performing this work.

B. Pack gloveboxes individually in totally enclosed wooden crates with pallets or provisions for handling by a forklift. Ship gloveboxes as complete assembled units except for support stand legs. Fully welded support stands to be shipped separately from the glovebox shell. If shipping limitations restrict complete assembly shipments, propose a recommended alternative for approval by LANL. Separately pack components or items that may work loose or be lost in transit.

C. Bag or crate any separate components that are part of the order and mark accordingly to describe or identify the glovebox with which the components are associated. Furnish packing material, weather protection, dunnage, and crating.

D. Provide desiccant bags inside gloveboxes to prevent condensation build-up during shipping.

1.19 CRATING

A. Provide lumber seasoned, reasonably sound, and free from cross grain and knots that would interfere with nailing or stapling, or knots that are greater than 1/3 the width of the lumber.

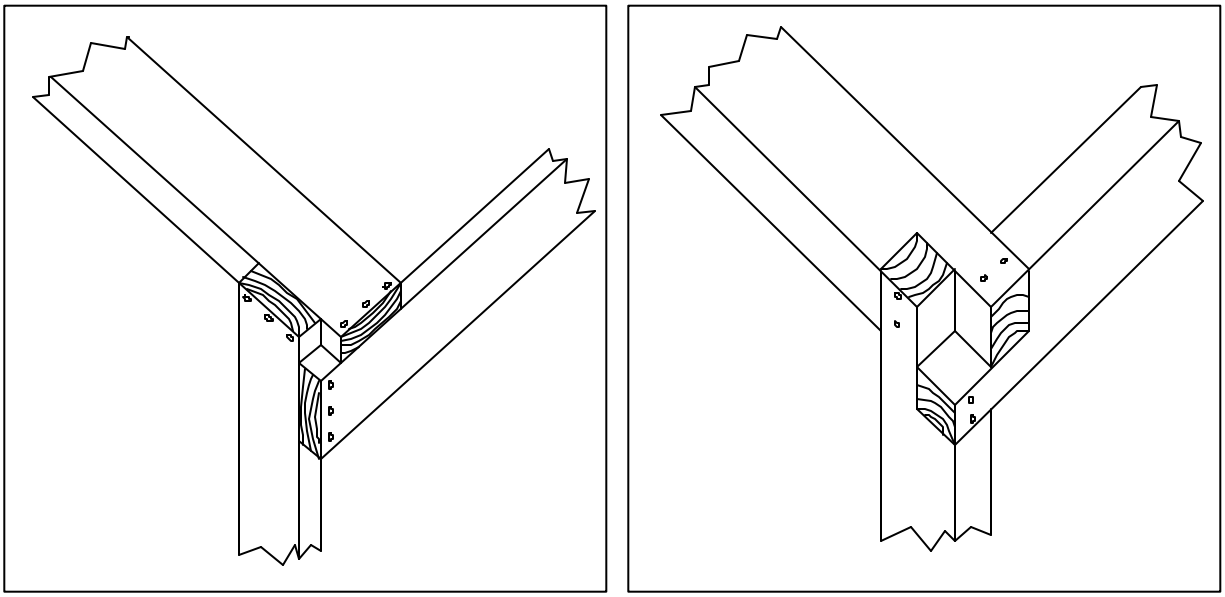
B. Construct crates with outer framework consisting of upright and horizontal members and with additional diagonal upright and horizontal members where necessary to provide proper strength and rigidity.

C. Construct crates with three-way lock corners, where members will be joined with nails or staples driven into side grain of joining members. See the following examples of three-way lock corners.

D. Use double nailing or stapling to fasten joining crate members.

E. Design and construct crates with transverse cross-members at the base sufficient in strength to protect the underside from damage by mechanical handling equipment.

EXAMPLES OF THREE-WAY LOCK CORNERS



F. Crate Marking: Properly and clearly mark crates on the top and four sides using a stencil. As a minimum, provide information including LANL contract number, glovebox number, and the actual weight of the crate and its contents. Identify each crate or package as a part of the total order, for example "Crate #1 of 5."

1.20 SHIPPING

A. Provide LANL with a copy of the bill of lading concurrent with the shipment. Properly and clearly describe the shipment on the bills of lading.

****

Provide final inspection and acceptance upon receipt of the shipment at Los Alamos. Inspect the shipment as necessary to ensure that received items have not been damaged during shipment and that required items and supporting documentation have been received.

****

1.21 RECEIVING

A. Final Inspection and Acceptance: LANL will inspect the shipment as necessary to ensure that received items have not been damaged during shipment and that required items and supporting documentation have been received. The receipt inspection by LANL at Los Alamos constitutes final acceptance.

1.22 WARRANTY

A. Guarantee the gloveboxes and glovebox equipment at design conditions and warrant that materials and workmanship or apparatus supplied, are in accordance with contract document requirements.

1.23 SITE CONDITIONS

A. Design gloveboxes and associated components for a design altitude of 7,500 feet above sea level at Los Alamos National Laboratory, located in Los Alamos County, NM.

B. Design gloveboxes and associated components for a design ambient temperature of 70° F.

PART 2 PRODUCTS

****

An approved vendors list shall be established for glovebox vendors in accordance with the appropriate Quality Assurance Program Plan. Authors shall select vendors from the approved vendors list.

****

2.1 SUPPLIERS

A. Companies specializing in designing and manufacturing the products specified in this section with suitable documented experience of performing similar work.

****

Determine and specify the type of material to be used for the glovebox shell, glovebox support stand and other appurtenances. Specify material based upon application and compatibility with the process and corrosive environments. (e.g. Carbon steel may be used for fabrication of the glovebox support stand in lieu of stainless steel, however, consider decontamination requirements outside of the glovebox. Coat carbon steel support stands with a decontaminable coating.)

****

2.2 MATERIALS

A. Provide new materials complying with this specification section and relevant standards

B. For glovebox shell materials use stainless steel type [304, 304L, 316 or 316L].

C. Stainless Steel Sheet

1. The phrase “300-series stainless steel” is used throughout this specification section. 300-series stainless steel refers to types 304, 304L, 316, or 316L stainless steel. Type 304L may be substituted for type 304, and type 316L may be substituted for type 316. Do not substitute type 304L or type 316L material when it is specified on the contract drawings. If 300-series stainless steel is specified, one of the four types of stainless steel as previously stated may be used at the discretion of the supplier.

2. Fabricate gloveboxes from 300-series stainless steel, as specified on the contract drawings. Use 7-gauge sheet stock with a No. 2B mill finish on both sides conforming to ASTM A240 and A480 for shell material.

3. Fabricate 16-gauge sheet used to cover the lead sheet on shielded gloveboxes from 300-series stainless steel as specified on the contract drawings. Provide sheet with a No. 2B mill finish on both sides.

4. It is recommended that the supplier purchase stainless steel sheet with a protective coating on both sides to protect the mill finish.

5. Provide to LANL a Certified Material Test Report, as part of the QA Document Package in accordance Section 01300.

D. Stainless Steel Plate

1. Do not use plate stock except where so specified in the contract drawings. When plate stock is required for use as a reinforced floor or as mounting pads for equipment, use the same grade of stainless steel as the shell material per ASTM A240. Polish the plate stock to the surface finish required by § 3.4.

E. Stainless Steel Bars and Shapes

1. Provide structural bars and shapes used in glovebox fabrication in the same grade of stainless steel as the glovebox shell material, meeting the requirements of ASTM A276.

2. Where approved by LANL, equivalent shapes may be fabricated by bending the appropriate sheet or plate stock.

F. Stainless Steel Forgings

1. Provide forged couplings and other forged pieces used in glovebox fabrication as the same grade of stainless steel as the glovebox shell material. Ensure forgings meet the requirements of ASTM A182 or ASTM A479. Castings are not permitted unless specified in the contract drawings. Castings are permitted for 150# rated pipe elbows. Couplings rated for 3000# may be used in lieu of couplings rated for 150# when the couplings are unavailable in the same material as the glovebox shell.

G. Stainless Steel Structural Shapes

1. Provide stainless steel structural shapes including channel, I-beam, and L-angle per the chemical and physical requirements of ASTM A276. Provide CMTR's with structural shapes.

H. Stainless Steel Structural Tubing

1. Ensure square and rectangular tubing used for the support stand meet the chemical and physical requirements of ASTM A554.

I. Carbon Steel

1. Ensure carbon steel for the glovebox support stand conforms to the chemical and physical requirements of ASTM A36 or ASTM A572 standards as specified on the contract drawings.

J. Welding Materials

1. Use filler materials that conform to ASME B&PVC Section II, Part C and as follows:

Base Material	Filler Material
Type 304 SS	ER 308
Type 304L SS	ER 308 L, or ER 347
Type 316 SS	ER 316
Type 316 L SS	ER 316 L

2. Provide CMTRs or CoCs for welding filler materials used in the fabrication process as part of the QA Document Package in accordance with Section 01300.

****
Determine and specify the appropriate lead thickness in accordance with radiation shielding analyses.
****

K. Lead

1. Ensure lead used in the fabrication of applicable portions of shielded gloveboxes meets the chemical requirements of ASTM B29. Submit a CMTR or CoC as part of the QA Document Package in accordance with Section 01300.

****
Determine and specify the type of gloveport to use for gloveboxes. Determine whether gloveports will be bolted into the glovebox shell or windows. Determine whether gloveports will be welded into the glovebox shell.
****

L. Gloveports

1. Use push-through gloveports from Central Research Laboratories (CRL) of the round or oval shape for gloveboxes. Provide weld-in or clamp-in gloveports. Fit gloveports with blank plugs.

2. Provide gloveports of the rolled and welded type or CRL push-through type for hoods.

3. Provide o-ring materials for bolt-in, push-through gloveports of type [Neoprene, Buna-N, Viton, Silicone].

****
Determine and specify type of viewing window material to use for gloveboxes.
****

M. Windows

1. Provide viewing pane material of [safety glass, leaded safety glass, polycarbonate resin (Lexan®), or chemically-strengthened glass (Toroglass®)]. Provide glass thickness of [1/4-inch, 3/8-inch, 1/2-inch, 5/8-inch].

2. Provide window materials with Certified Material Test Reports (CMTR). Certificates of Conformance (CoC) may be provided in lieu of CMTR's with prior approval from LANL.

    a. Safety Glass: Provide safety glass with two equal layers of annealed plate joined by a 0.030- to 0.050-inch laminate layer of polyvinylbutyryl (PVB). Provide safety glass with a density of 2.5 and a refractive index of 1.52. Provide glass meeting the requirements of ASTM C1036 and ASTM C1172.

    b. Leaded Glass: Use lead impregnated safety glass where approved by LANL for shielding window applications. Coat lead glass with float glass on both sides for protection from scratching and chipping. Lead glass density should not exceed 5.2 to avoid yellowing

    c. Polycarbonate Resin: Provide fire retardant grade Lexan® with silicate coating (MARGuard).

    d. Chemically-Strengthened Glass: Provide chemically strengthened, laminated safety plate glass, Toroglass® from Hot Cell Services. Provide plate glass with a density of 2.5 g/cc with an index of refraction of 1.52.

3. Provide window gasket elastomers of black neoprene, with durometer between 40 and 60, shore A.

N. Fasteners

1. Provide fasteners with Certified Material Test Reports (CMTR). Certificates of Conformance (CoC) may be provided in lieu of CMTR's with prior approval from LANL.

2. Use UNC-series threads with screws, fasteners and components with mating threads.

3. Provide bolts and cap screws with grade marks.

4. Implement provisions to ensure that materials used or supplied are not counterfeit or of other suspect origin. Pay particular attention to high strength bolting materials (grade 5 and 8 strength) and pipe fittings. Reference Attachment 6 for further guidance on suspect fasteners.

5. Stainless Steel

    a. Unless otherwise specified on the contract drawings, use stainless steel for nuts and washers used in the glovebox fabrication.

b. Use the following stainless steel fasteners, type 304, 304L, 316 or 316L, in the design of gloveboxes.

i. Bolts and Hex Head Cap Screws: ASTM F593, Grade 2A.

ii. Nuts: ASTM F594, Grade 2B.

iii. High Crown Acorn Nuts: AISI 300-series

c. In the event that fasteners are not readily available meeting the requirements of ASTM F593 and ASTM F594, then fasteners meeting the requirements of ASTM A193 and ASTM A194, respectively may be substituted with prior approval by LANL.

d. Ensure graded stainless steel fasteners conform to the following standards: ANSI B18.2.1, SAE J429, and ASTM A354.

6. Carbon Steel

a. Carbon steel bolts per ASTM A307 or A325 and nuts per ASTM A563A. Ensure graded carbon steel fasteners conform to the following standards: ANSI B18.2.1, SAE J429, and ASTM A354.

7. Stainless Steel Weld Studs

a. Ensure Capacitive Discharge (CD) weld studs welded to the exterior of the glovebox are 300 series stainless steel and meet the chemical requirements of ASTM A276. Ensure weld studs welded to the interior of the glovebox are of the same type stainless steel as the glovebox shell. Provide CoCs with CD weld studs.

O. Electrical Feedthroughs

1. Provide feedthroughs in accordance with NFPA 70, National Electrical Code (NEC).

2. Utilize hermetically sealed feedthroughs for electrical power and instrumentation wiring shell penetrations. Use products from Douglas Engineering or PAVE Technologies.

3. Use push-through type hermetically sealed feedthroughs where frequent replacement of wiring is expected, such as in corrosive atmospheres.

P. Material Transfer Devices

1. Provide material transfer devices including [bagports, double-door transfer systems, airlocks, input sphincter, introductory tubes]. Attachment 1 of this section provides design details of some of these material transfer systems.

2. Provide double-door transfer systems from Central Research Laboratories. Provide double-door transfer systems of diameter [105 mm, 190 mm, 270 mm, or 350 mm].

3. Provide [rolled and welded bagport, or CRL push-through bagport] for use with [30-gallon drums, 55-gallon drums]. Provide rolled and welded bagports in accordance with drawings in Attachment 1.

4. Provide airlock of size [XX-inches diameter by XX-inches long]. Provide airlock doors of a [counterbalance style or guillotine style]. Provide a slide tray inside the airlock.

****

For non-UL rated components, verify the acceptability of the components prior to their use by the supplier.

****

Q. UL-Rated Components

1. Where certified products from Underwriters Laboratories Inc. (UL) or another nationally recognized testing laboratory are available for the glovebox design provide them in front of non-certified units. Request approval from LANL for the use of non-UL certified products.

R. Paint

1. Primer

a. Provide coating materials of the type and color specified on the contract drawings. If unspecified, use a heavy-duty primer (PLASITE® 7102 Heavy Duty Primer by Wisconsin Protective Coatings, or equal). Provide a primer that meets the following requirements:

i. Minimum dry film thickness of 2.5 mils.

ii. Heat resistance of 200° F.

iii. Minimum volume solids content of 43%.

2. Finish

a. Ensure coating materials are of a type and color specified on the contract drawings. If unspecified, use a cross-linked epoxy-phenolic cured finish with an alkaline curing agent (PLASITE® 7122 by Wisconsin Protective Coatings, or equal). Provide a finish that meets the following requirements:

i. Pearl gray color.

ii. Minimum dry film thickness of 5 mils.

iii. Heat resistance of 200° F.

PART 3 EXECUTION

3.1 GENERAL FABRICATION REQUIREMENTS

A. Perform cutting with mechanical shop tools, plasma arc, laser, or water jet. Do not use carbon arc or iron powder cutting on stainless steel.

B. Ensure cut or raw edges are deburred and smooth to the touch.

C. Ensure shell bends have an inside radius of 5/8 inches with other bends having a minimum inside radius equal to the thickness of material, unless otherwise specified on the contract drawings.

D. Chase coupling threads with tap after the coupling is welded into place.

E. Use wire brushes made of stainless steel. Ensure grinding wheels and wire brushes are new or previously used only on stainless steel.

F. Temporary carbon steel clamps, supports, braces, and fixtures used during fabrication are not be welded directly to, or come into direct contact with, any stainless steel surfaces. Do not use galvanized steel clamps or fixtures.

G. Clean press brake dies with solvent before use in forming stainless steel materials. Ensure carbon steel parts of the press brake that will come in contact with the stainless steel material are masked or covered to control carbon contamination.

H. Provide a weld fit-up inspection after the glovebox is formed and tack welded in place but before final welding. This inspection will also include the preliminary dimensional inspection. Provide LANL with a seven (7) working day advance written notice so that a LANL representative may witness the activity.

3.2 DIMENSIONAL CONTROL

A. Ensure dimensions and tolerances specified on the contract drawings apply to the finished glovebox or component.

****

Delete the “Lead Placement” section for non-shielded glovebox specifications.

****

3.3 LEAD PLACEMENT

A. Do not glue lead to the glovebox, for shielded gloveboxes requiring lead sheet application.

B. Ensure there are no gaps in the lead joints. Eliminate gaps by filling with lead wool, fusion welding, or by peening.

C. Ensure lead applied in multiple layers have staggered joints.

D. Ensure gaps between lead sheets and structural framing are no larger than 1/8 in.

E. Pack lead wool into gaps between lead sheets and structural framing.

F. Provide LANL with a seven (7) working day advance written notice so that a LANL representative may inspect the lead fit-up, prior to being covered with cladding.

3.4 SURFACE FINISHES

A. In order to preserve the original finish of the stainless steel sheet material, exercise care to prevent scratching, abrading, nicking, and denting during receiving, storage, fabrication, and handling. Preserve the original protective coating as long as possible.

B. After fabrication is completed and before testing and inspection, clean, de-scale, and degrease gloveboxes and associated components. Do not paint stainless steel surfaces, interior or exterior, unless specified on the contract drawings.

C. Surface finishes for gloveboxes are specified below and on the contract drawings.

1. Exterior: Provide exterior surfaces with a 2B sheet finish except welds or damaged surfaces.

2. Interior: Provide interior surfaces with a 2B sheet finish except welds or damaged surfaces.

3. Cladding: Provide cladding surfaces with a 2B sheet finish except welds or damaged surfaces.

4. Welds: Grind and polish welds parallel to the weld to a 32-microinch-roughness height (arithmetical average) finish and blended to the adjacent material. Limit grinding and polishing to the zone disturbed by the welding not exceeding a 2-in. width. Ensure welds covered by shielding are ground so that there is no unevenness in the shielding. Perform liquid penetrant testing on welds covered by shielding.

5. Damaged Surfaces: Polish damaged surfaces to a 32-microinch-roughness height (arithmetical average) finish. Limit the extent of refinishing to the immediate damaged area.

6. Plate: When plate stock is required, polish it to a 32-microinch-roughness height (arithmetical average) finish. Grind plate surfaces to remove pickled finish. Liquid penetrant plate surfaces to locate pits. Repair pits with weld. Grind repair welds and liquid penetrant test again, until pits are removed. Grind and polish repairs to blend with the surrounding material.

7. Appurtenances: Finish appurtenances, such as, but not restricted to doors and door hardware, shelves, brackets, and machined components to a 32-microinch-roughness height (arithmetical average).

8. Openings: Polish a band 1-inch wide around window and panel openings to a #4 finish such that the grain is parallel to the edge of the opening.

3.5 WELDING

A. Welder Performance Qualification Records (WPQ): Ensure welders, welding operators, and tackers are qualified in accordance with ASME Boiler and Pressure Vessel Code (B&PVC) Section IX. Use welders who have successfully performed welder certification tests in the 3G position. Use welders for welding pipe and tubing who have successfully performed welder certification tests in the 6G position. Provide WPQs for personnel performing welding operations on the gloveboxes. Submit these records to LANL for approval, prior to fabrication.

B. Welding Procedure Specification (WPS): Use welding procedures specifying standard stainless steel (P8 to P8) WPS per ASME B&PVC Section IX. The range of material thickness covered by the procedure is 3/16 in. Provide a weld procedure that addresses weld repair and welding equipment. Submit the welding procedure to LANL for approval, prior to fabrication.

C. Welding Procedure Qualification Record (PQR): Use welding procedures, including weld repair procedures, meeting the requirements of ASME B&PVC Section IX. This record is a standard PQR for ASME B&PVC, Section IX, which qualifies the supplier's procedure for welding stainless steel (P8 to P8). Submit the PQR to LANL for approval, prior to fabrication.

D. Welding Processes:

1. Unless otherwise stated on the contract drawings, do not weld carbon steel to stainless steel.

2. Perform stainless steel welding using GTAW (TIG) methods. GMAW (MIG) welding methods are not allowed.

3. Use shielding gas as specified in the supplier's welding procedure specifications.

E. Cleaning Before Welding: Prior to welding, interior and exterior surfaces, remove dirt, scale, corrosion, dust, grease, oil, water, or foreign material. Do not use a carbon steel brush for cleaning.

F. Weld Joint Design:

1. Material 1/8 in. or thinner may be fusion welded without joint spacing between work pieces. Bevel material of 1/8 in. or thinner if required to obtain the specified full penetration weld.

2. Bevel material with thickness greater than 1/8 in., but less than 1/2 in., to provide a 1/16 in. flat nose with either a 60° V-type or 75° U-type butt joint.

3. On tee and corner joints or material 1/8-in thick or greater, provide one work piece with a 45° bevel and with a 1/16-in. flat nose.

G. Butt Welds

1. Provide butt welds with full penetration and with a uniform transition from the joined materials into the weld deposit. Ensure the welds are free of undercutting and un-fused overlap of the weld deposit.

2. Ensure the width of the finish weld layer of butt welds are held to a minimum and do not exceed the width of the weld groove by more than 1/16 inch.

H. Fillet Welds

1. Provide fillet weld surfaces with a uniform transition from the joined material into the weld deposit. Provide welds free of undercutting and un-fused overlap of the weld deposit.

2. Provide fillet welds, unless otherwise specified, symmetric with respect to the components they join.

3. Ensure the minimum permissible length of each leg of a fillet weld is equal to the required size of the weld as called out on the procurement drawing, or equal to the thickness of the lighter section being joined if no size is specified. Seal welds are sufficient for sealing with no minimum size requirements.

I. Weld Defects

1. Provide welds free from defects including the following defects and conditions:

a. Cracks of any description in the weld or base metal.

b. Crater checks or cracks.

c. Slag inclusions, oxide inclusions, or gas holes.

d. Cold laps in the deposited weld metal.

e. Overlap of weld metal on the base metal.

f. Undercutting at the edge of the welds. Ensure no part of the finished face of weld in the area of fusion of welded joints lies below the surface of the base metal adjoining the weld.

g. Depressions in butt welds below the work piece surface on either side of the welded seam.

h. Unfilled weld craters or shrinkage cavities.

i. Evidence of damage to the weld metal through oxidation. Oxidation is defined as scaling of the metal that cannot be removed or restored to a bright metal by wire brushing with a stainless steel brush. Heat discoloration or blackening is not considered oxidation.

j. Weld spatter.

k. Arc burns or scars on the base metal caused by striking or dragging the welded arc across the base metal.

l. Butt welds with less than 100% penetration. Butt joints normally welded from one side only may be welded from both sides to obtain 100% penetration, provided that no excessive warping occurs in the sections being joined.

m. Intermittent or skip welding, except on exterior stiffeners and unless specified as such on the contract drawings.

J. Stud Welding

1. Use only capacitive discharge (CD) weld studs, unless a stud size larger than 5/16-inch in diameter is specified on the contract drawings.

2. Remove weld spatter.

3. Provide base of male and female studs flush with the plate to which they are welded. Ensure the axis of studs is perpendicular to the plate to which they are welded within 2°.

4. Perform stud gun testing whenever a series of male or female studs are to be welded. Provide a stud gun test procedure before fabrication.

5. Submit test reports for each series of stud welding. Perform the setup and testing as described below:

   a. Shoot five studs onto a test plate of the same material as the glovebox shell.

   b. Submit each of the five studs to a torque test or a tensile test.

      - Ensure the torque testing apparatus meets the requirements of ASME B&PVC Section IX, paragraph QW-466.5. Provide tensile testing apparatus in accordance with ASME B&PVC Section IX, paragraph QW-466.6.

      - Ensure the acceptance criteria is as specified in ASME B&PVC Section IX, paragraph QW-192.3.

      - If female studs are to be tested, determine the stud size by the nominal thread size and not the diameter or base size.

6. Stud Test Reports: Provide test reports for each series of stud welding operations. Ensure these tests comply with the supplier's stud test procedure. Include the following information in the test reports:

   a. Glovebox identification.

   b. Date of test.

   c. Name and signature of test operator.

   d. Stud gun make, model and settings.

   e. Torque values at failure or tensile values at failure.

f. Failure mode of each of five test studs.

3.6 STAINLESS STEEL CUTTING

A. Air arc cutting of stainless steel is not permitted.

B. If plasma cutting is used, grind cut surfaces to remove fused surface.

C. If stainless steel is nibbled, grind points

D. Shearing of material is acceptable

E. Laser or water jet cutting preferred.

3.7 CHLORIDE CONTENT CONTROL

A. Exercise control during stages of fabrication to minimize exposure of stainless steel to contaminants, in particular any chloride that might cause stress-corrosion cracking.

B. Avoid chloride-bearing compounds; however, if used, they must be completely removed by thorough cleaning. Use compounds, liquids, or markers that come into contact with stainless steel surfaces with no more than 250 ppm by weight chloride.

C. Submit Material Safety Data Sheets or independent lab test reports showing chloride content as part of the QA Document Package in accordance with Section 01300 for cleaning solvents, tape adhesive, and marking pens.

3.8 PAINTING

A. Scope: Paint carbon steel in accordance with this specification and as required by the contract drawings. Do not paint stainless steel components.

B. Surface Preparation

1. Clean and properly prepare surfaces to be coated before any coating is applied. Prevent rusting and/or contamination of cleaned or primed surfaces. Coat the cleaned surfaces the same day cleaning is done and before detrimental corrosion or recontamination occurs. Remove oil, grease, and other contaminants by solvent cleaning in accordance with SSPC SP-1 before any mechanical cleaning.

2. Use abrasives for blast cleaning that are clean and dry. Select abrasives to provide a proper surface profile for the subsequent priming materials. Ensure air pressure supply lines for blasting have effective and proper moisture and oil trap filter devices. Perform blast cleaning in accordance with SSPC SP-6.

C. Application

1. Apply paint to dry, clean, adequately prepared surfaces, in accordance with manufacturer's instructions. Properly cure each coat of paint according to manufacturer's instructions before applying additional coats.

2. Ensure paint containers remain closed until required for use. Mix paint before use in accordance with manufacturer's instructions. Provide agitation during application where specified by the manufacturer.

3. If the total dry film thickness is not obtained in one coat, apply additional coats until the specified thickness is provided.

4. Apply coats in such a manner as to produce a film of uniform smoothness. Pay special attention to crevices, weld lines, bolt heads, corners, and edges to obtain the required thickness.

5. Follow the manufacturer's instructions for thinning, mixing, handling, and applying the products as part of these specifications.

****
Determine and specify appropriate information for filling in glovebox labels.
****

3.9 LABELING

A. Attach an identification nameplate to each glovebox with the glovebox number and procurement drawing number on the first line and the grade of stainless steel and the weight of the glovebox on a second line as shown in the example below.

2001-GB-100	55Y-999999
304L	1200 LB

B. Provide nameplate manufactured from 16-gauge stainless steel of the same grade as the glovebox shell. Provide nameplate with dimensions of 2-in. high and 5.5-in. long, fusion welded to the exterior of the glovebox. Etch or engrave lettering into the nameplate with 3/8-in. high letters and numbers. Place the nameplate at the lower right corner of the front of the glovebox if possible.

C. A supplier identification nameplate may be attached to the glovebox above the welded nameplate. Ensure the supplier nameplate does not exceed eight (8) square inches.

3.10 ASSEMBLY

A. Conditions

1. Assemble gloveboxes in a clean, dust-free area of the supplier's shop.

2. Assemble multiple adjoining gloveboxes together in an upright position on a level surface.

3. Check to ensure the entire length and height of the gloveboxes are straight and plumb in accordance with the contract drawings.

B. Support Stand

1. Bolt the support stand frame to the glovebox to stabilize the glovebox structure before shop acceptance testing.

2. Completely fabricate, assemble, inspect, and paint the support stand before attachment to the glovebox. Do not paint stainless steel support stands.

3. Keep support stand attached to the glovebox for subsequent fabrication operations, inspections, tests, packaging, and shipping.

4. The support stand or support stand legs, after being attached for verification to dimensions and tolerances specified by contract drawings, may be removed during glovebox shipping.

5. Use the support stand frame as a template for determining stud location on the glovebox.

3.11 CLEANING

A. Procedure

1. Submit, for review and approval, a cleaning procedure describing the methods, materials, controls, and inspections to be used to perform glovebox-cleaning operations.

2. Provide procedures that address cleaning glovebox surfaces to remove dirt, oils, and marking pen ink. Provide procedure that also includes a specification of the solvents and/or detergents that will be used.

3. Clean both interior and exterior surfaces by removing weld spatter, oil, grease, markings, from pens and dyes, shop soil, and visible rust. Use cleaning methods that do not introduce iron or chloride contamination. Methods may include cleaning by hot water spray or solvent wiping. Submit the procedure to LANL for approval, prior to fabrication.

4. Ensure the cleanliness of the glovebox meets the approval of LANL at the time of the final inspection.

B. Detergent: If a detergent is needed to ensure thorough cleaning, use a detergent that is low in chloride. Use fresh water for final wash and rinse. Ensure the detergent, wash, and rinse contains less than 250-ppm chlorides. After the water rinse, dry inside surfaces use heat, lint-free cloth, or other means to ensure cleanliness. If heat is used for drying, ensure the final rinse water is fully softened, low chloride water with less than 250-ppm chloride.

3.12 SHOP ACCEPTANCE TESTS

A. Perform the following:

1. Perform helium leak testing required by this specification.

2. Perform non-destructive examination including liquid penetrant testing where required by this specification.

3. Perform dimensional inspection (overall dimensions only) required by this specification.

4. Perform surface finish inspection required by this specification.

5. Perform additional tests and inspection required by this specification.

6. Provide the test location, equipment, and instrumentation of certified accuracy and any supplementary temporary connections and auxiliary parts necessary to fully execute the tests.

7. Provide test personnel qualified to conduct, record, and verify test results.

8. Provide LANL with a seven (7) working day advance written notice of shop acceptance tests.

9. Submit the test results as part of the QA Document Package in accordance with Section 01300.

3.13 NON-DESTRUCTIVE EXAMINATIONS PERSONNEL (NDE) CERTIFICATIONS

A. Provide NDE personnel performing leak testing and liquid penetrant testing operations certified in accordance with the requirements of ASNT SNT-TC-1A.

B. Unless witnessed by LANL, provide test reports with signatures by personnel who either performed or witnessed the test and who hold either Level II or Level III certification.

C. Provide NDE certifications for personnel performing or witnessing the following non-destructive testing inspections:

1. Helium Leak Test

2. Liquid Penetrant Test

D. Submit the NDE certifications for test personnel for approval, prior to testing.

3.14 HELIUM LEAK TEST

A. Perform a helium leak test on gloveboxes, with the exception of open front boxes. Perform preliminary leak tests and repair welding prior to the shop acceptance test. Perform the final leak test as the shop acceptance test, which must be witnessed by LANL's representative. Perform the leak tests in accordance with ASTM E498 or ASTM E499.

B. Procedure

1. Submit a leak test procedure to LANL for approval, prior to testing. Include in the procedure requirements set forth in this specification.

2. Describe the methods, materials, controls, and inspections used to blank off glovebox openings in the procedure. The requirements for creating a helium atmosphere within the glovebox and how leak detection operations are accomplished is described in this procedure.

3. Test report forms are also a part of this procedure.

C. Assembly: Assemble the glovebox as much as practical. Provide a glovebox assembly including windows, supplied connectors, and filter housings, but not gloves. Seal openings in the glovebox shell such as gloveports and connecting rings externally with gasketed blank-off plates. Provide blank-off plates and test coverings for openings.

D. Pressure: Perform testing at a test pressure of 4 in. of water gauge pressure. To prevent pressurization above 6 in. of water gauge pressure, protect the glovebox during the test using a pressure relief device.

E. Atmosphere

1. Provide atmosphere within the glovebox during testing with at least 90% helium. Establish the required atmosphere by using either of the following methods:

2. Purging Method: Connect a helium gas supply to a penetration in the top of the glovebox. A penetration panel coupling may be used or a fitting may be placed in a window blank-off plate. Locate a vent near the bottom of the glovebox. Flow gas from the top to the bottom of the glovebox. Relate the purge flow and time by the following equation,

$$T = 2.3\ V/Q,$$

where T is the time required for the purge, Q is the helium flow rate, and V is the glovebox volume.

3. Balloon Method: Place a weather balloon or plastic bag in the glovebox and fill it with helium until it expands to completely fill the glovebox. Release the contents of the balloon by reaching through a glove on the glovebox.

F. Calibration: Use leak detector that has been previously calibrated within the last 12 months against a National Institute of Standards and Technology standard leak. Use a calibrated standard leak rate between 10^{-6} and 10^{-7} standard cc/sec.

G. Leak Detector Probe: Move the leak detector probe along accessible joints and welds no faster than 24 in. per minute. Locate and repair any detectable leak (at the range of 10^{-6} to 10^{-7} standard cc/sec) in a weld or coupling plug. Rework and repair leaks until leaks are eliminated.

H. Shielded Gloveboxes: Test lead shielded gloveboxes for leakage into the shielding jacket by probing the gaps around the gloveports with the leak detector. Check neutron shielded gloveboxes at the fill port for helium. If helium is present, locate and repair the leaks in the shell seams.

I. Reports: Provide helium leak test reports for each glovebox tested other than open front boxes. Submit final leak test reports as part of the QA Document Package in accordance with Section 01300. Include the following information in the test report:

1. Glovebox identification.

2. Date of test.

3. Name and signature of the test operator.

4. Make and model of test equipment.

5. Calibrated leak data.

6. Calibration data if detectors do not have direct leak indication.

7. Signature of witness.

3.15 WELD INSPECTION

A. Visually inspect welds at the supplier's shop during shop acceptance tests. Perform liquid penetrant testing on primary confinement interior welds and any welds so specified on the contract drawings in accordance with ASME B&PVC, Section V.

B. Perform liquid penetrant testing after grinding and polishing operations. Repair and re-test detected defects. Submit a liquid penetrant test procedure for approval prior to performing the work. Include test report forms as a part of this procedure. Submit the final liquid penetrant test reports as part of the QA Document Package in accordance Section 01300.

C. Liquid Penetrant Test Reports: Provide liquid penetrant test reports for liquid penetrant inspection of welds or polished plate as required by the contract drawings and this specification. Include the following information in the test report:

1. Glovebox identification.

2. Date of test.

3. Name and signature of the certified test operator.

4. Location and description of indications.

5. Description of repairs and retest.

6. Signature of witness.

3.16 DIMENSIONAL INSPECTION

A. Perform dimensional inspection on the glovebox with a LANL witness present. Verify that the fabricated glovebox is within the overall dimensions and tolerances required by this specification and as shown on the contract drawings.

B. Use the as-built drawings to document the dimensional inspection as required by § 1.7.E.6.

****

Witness the surface finish inspection on gloveboxes at the supplier's shop prior to shipment to the LANL site.

****

3.17 SURFACE FINISH INSPECTION

A. Perform a surface finish inspection on gloveboxes to verify conformance of surface finishes to the requirements stated in § 3.4. Perform inspection with a LANL representative present to witness the inspection. Use a Surface Roughness Analyzer at random places for inspection of the weld and damaged areas. Polish scratches and imperfections detectable by touch.

Section 11610 - Attachment 1
Alpha Confinement Glovebox Drawing List

Drawing #	Drawing Title
26Y-202001	General Notes
26Y-202002	Lead Shielding & Cladding for Zippered and Bolted Gloveboxes
26Y-202005	Lead Glass Shields for Zippered and Bolted Windows
26Y-202006	Zippered Window Assembly
26Y-202008	Bolted Window Assembly
26Y-202010	Shell Penetrations
26Y-202013	Typical Gloveport Ring
26Y-202014	Bolted Service Panel Assemblies
26Y-202015	Top Access Panel Assembly
26Y-202018	Bag Ring Assemblies
26Y-202019	Removable Shelf Assembly
26Y-202021	Cooling Well Assembly
26Y-202022	Resistance Furnace Well
26Y-202023	14” Dia. Airlock Assembly
26Y-202024	Standard Airlock Slide Tray Assembly
26Y-202026	Connector Ring Closure Cap Assy & Connector Assy
26Y-202031	14” Dia. Welded Connecting Ring Assembly
26Y-202032	Sample Taking Port Assembly
26Y-202034	Reagent Transfer Device Assembly
26Y-202035	Introductory Tube Assembly
26Y-202039	16” Square Connector Assembly
26Y-202046	Air Cylinder Mounting Assembly
26Y-202047	Air Operated Vertical Sliding Door Assembly
26Y-202048	14” Dia. Opening Counterbalanced Door Assembly 151 R/L
26Y-202049	16” Square Airlock Sliding Door--Hydraulic
26Y-202050	14” Dia. Opening Air Operated Vertical Sliding Door Assy
26Y-202052	Introductory Boxes and Hoods Exhaust Transition Piece
26Y-202053	Introductory Boxes and Hoods Upper & Lower Door Assy’s
26Y-202057	8” Dia. Exhaust (HEPA) Filter Assembly
26Y-202059	8” Filter Housing Assembly
26Y-202060	Pressure Relief Device 161 Assembly
26Y-202066	Std. Hi-Vac System Diffusion Pump Mounting Flange Assy
26Y-202067	Dutchman Assembly
26Y-202075	Tunnel Dropbox Transition with Firedoor Assy (2 dr)
26Y-202076	Typical Dropbox Detail Bolt Pattern for Transition
26Y-202077	Tunnel Dropbox Transition with Firedoor Assy 167 (1 dr)
26Y-202121	2 x 3 Glovebox Support Stand Assy
26Y-202122	2 x 2 Glovebox Support Stand Assy
26Y-202123	1 x 3 Glovebox Support Stand Assy
26Y-202124	1 x 2 Glovebox Support Stand Assy
26Y-202125	1 x 1 Glovebox Support Stand Assy
26Y-202130	12” Dia. Exhaust (HEPA) Filter Assembly
26Y-202131	Neutron Shielded Glovebox Details
26Y-202150	O-Ring Gasket Seal Tubing to Valve Joint
26Y-202151	3” and 2 1/4” I.D. Damper Assembly
26Y-202152	4” In-Line Filter Holding Bracket
26Y-202153	Open-Front Glovebox 7 1/2” Sash Assembly

Material	Stability		
	Good 10^5 Gy	**Satisfactory** 10^4 Gy- 10^5 Gy	**Poor (Do not use)** 10^4 Gy
Rubber ASTM D 2000 ASTM D 1056	Polyurethane [1] SBR Butadiene styrene Ethylene propylene copolymer [2] EPDM Polychloroprene [5]	Natural Rubber Butadiene-acrylonitrile copolymer NITRILE Polysulphide Polybutadiene	Fluorocarbon [3] VITON Butyl Silicon [4] Neoprene
Thermoplastics	Polystyrene Polyethylene Chlorosulphonated Polyformaldehyde Hypalon ABS PVA Polyamide [6] Nylon Polycarbonate Polyester [7] Mylar or Melinex	Polymethylmethacrylate PERSPEX Chlorofluorocarbon [8] KEL-F	Fluorocarbon [9] PTFE, Teflon, Fluon Polypropylene
Thermosets	Epoxy Resin ARALDITE Styrene modified polyesters [10] (Mineral or unfilled) Polyurethane [1] Polyetheretherketone EEK Silicone [11]		Styrene modified polyesters [10] (unfilled) Amino-Formaldehyde Phenol formaldehyde BAKELITE
Adhesives	Epoxy Resin ARALDITE Phenolics [12]		Pressure sensitive type [13]
Lubricants	Mineral Oils [14] (radiation resistant grades)	Synthetic Lubricants [14] & [15]	Natural Oils (Vegetable etc.)
Others	Metals Concrete Glass [16]	Cork & Wood [17]	

NOTES:

(1) Polyurethane can be either polyether or polyester based. Polyether based polyurethanes are some of the most radiation resistant rubbers. However polyesters are susceptible to hydrolysis and should not be employed in humid radioactive environments.

(2) Ethylene propylene copolymers are the most radiation stable rubbers.

(3) Fluorocarbons release highly corrosive fluorine/hydrogen fluoride on irradiation.

(4) Silicone rubbers are composed of an inorganic backbone of silicon and oxygen with organic side groups. The side groups may break off during irradiation thus affecting the characteristic properties of the material. There is also the possibility of the side groups containing corrosive halogens.

(5) Polychloroprenes degrade under irradiation releasing corrosive chlorine/hydrogen chloride.

(6) Polyamides include the nylons in which damage is caused by the combined effects of ionizing radiation and oxygen. Therefore the size of the component (surface to volume ratio) will affect the radiation stability, larger components will survive longer.

(7) Polyesters are susceptible to hydrolysis. Therefore their stability is greatly reduced in moist conditions.

(8) Chlorofluorocarbons will release corrosive halogens during irradiation.

(9) Fluorocarbons degrade rapidly in radioactive environments and are also affected by oxygen (See Note 6above). Fluorine is liberated which is highly corrosive.

(10) Styrene modified polyesters exhibit a range of radiation stability dependent upon whether or not they are filled. The presence of inorganic fillers reduces radiation damage of the polyester. This is due to the radiation being absorbed throughout the component and inorganic materials are little affected by radiation.

(11) Silicone based Thermosets are more resistant to radiation than their rubber counterparts due to the presence of stable styrene side groups and fillers. (See Note 10 above).

(12) Formaldehyde Phenolics have very poor radiation stability.

(13) Some adhesives release vapors during curing so that pressure should be applied evenly to bond areas to avoid porous joints.

(14) Aromatic lubricants (containing closed ring molecules/benzene rings) are more resistant to radiation than aliphatics (straight chain modules).

(15) Almost all synthetic lubricants do not offer any advantage over mineral oils in terms of radiation stability. However, they may be used when their increased fire resistant, chemical and thermal stability are required.

(16) Radiation stabilized glass should be used if discoloration transmission loss cannot be tolerated.

(17) Cellulose based materials degrade in radiation and release fumes. The material eventually becomes tacky.

Section 11610 - Attachment 3
Glovebox Design Checklist

1.0 Form

1.1 Are the glove box internal / external surfaces decontaminable? - Is the proposed surface finish, suitable for the requirement?

1.2 Does the glove box have clean lines? Is it self-draining / self-cleaning with no powder traps?

1.3 Does the glove box have a simple shape with the minimum of fabrication and machining?

2.0 Manufacture

2.1 Materials

2.1.1 Is stainless steel required?

2.1.2 Are materials compatible to each other and to the process?

2.1.3 Do the materials of manufacture give suitable shielding protection?

2.1.4 Are Jigs / Fixtures / Tooling required or necessary to aid in manufacturing?

2.1.5 Are flammable or combustible liquids used?

2.1.6 Are Class A combustibles used? Has prior approval been obtained?

2.1.7 Are materials covered by the Resource Conservation Recovery Act (RCRA) used that may cause a mixed waste disposal problem?

2.2 Fasteners

2.2.1 Is the fastener material compatible with the parent material?

2.2.2 Are the sizes of fasteners standardized throughout the glovebox?

2.2.3 Are acorn nuts used? – Have sharp corners on exposed nuts been removed?

2.2.4 Are captive fasteners required to aid maintenance?

2.2.5 Are fasteners accessible by boxed end wrenches or sockets?

2.3 Lubricants

2.3.1 Are lubricants necessary within the glovebox?

2.3.2 Can the lubricated item be placed outside the glovebox - through wall drive system?

2.3.3 Are lubricants required to be radiation tolerant?

2.3.4 Does the lubricated item require re-lubricating on a regular basis?

2.3.5 Are there reservoirs for lubricants?

2.3.6 Are the flashpoints of the lubricants below 400° F?

3.0 Viewing and Access

3.1 Are the viewing lines through windows believed to be acceptable for normal operation?

3.2 Are the viewing lines through windows believed to be acceptable for maintenance operations?

3.3 Is the access into the glovebox believed to be acceptable for normal operation? - Are there any restrictions i.e. other equipment features or fittings?

3.4 Is the access into the glove box believed to be acceptable for maintenance operation? - Are there any restrictions i.e. other equipment, features or fittings?

3.5 Do the viewing materials give suitable shielding protection?

3.6 Are there any special viewing requirements? - Inspection purposes, etc.

4.0 Maintenance

4.1 Do removable items fit into the bagport / material transfer port envelope?

4.2 Are suitable set down areas provided within the glove box confinement?

4.3 Are there any special recovery requirements?

4.4 Can modular items inside glovebox be manually handled (less than 13 lb.), or is material handling equipment required?

4.5 Is calibration equipment provided for material handling equipment? (e.g. test weights)

5.0 Calculations and Data Sheets

5.1 Are sizing and other calculations available?

5.2 Are manufacturers specifications available?

5.3 Is shielding adequate?

5.4 Is structural integrity appropriate to meet performance requirements?

5.5 Check mass and facility floor loading.

6.0 Ventilation

6.1 Has the ventilation of the glovebox been considered?

6.2 Does the glovebox contain powder or solid material?

6.3 Does the glovebox maintain capture velocity at opening when and opening is breached?

6.4 What is the atmosphere within the glovebox? If an inert gas, will instrumentation continue to function?

6.5 Is there potential for static atmosphere within the glovebox?

7.0 Operation

7.1 Does the glovebox perform its required operation?

7.2 Could the operation be simplified?

7.3 Could the time at the glovebox face be reduced to lower operator dose?

SUPPLIER DEVIATION DISPOSITION REQUEST		
SDDR#	SUBMITTAL DATE:	DISPOSITION DATE:

SUPPLIER

SUPPLIER NAME _____

FACILITY ADDRESS _____

TELEPHONE # _____ FACSIMILE # _____

LANL PURCHASE ORDER/CONTRACT # _____

DEVIATION DESCRIPTION: (Proposed exception, deviation or change. Reference existing requirement in specification or drawing. Attach additional sheets as necessary.)

_____

_____

_____

SUPPLIERS PROPOSED DISPOSITION: _____

_____

_____

TECHNICAL JUSTIFICATION FOR DEVIATION: _____

_____

_____

COST AND SCHEDULE JUSTIFICATION FOR DEVIATION: _____

_____

_____

SUPPLIER'S AUTHORIZED REPRESENTATIVE: _____ _____
(Name) (Date)

LANL

LANL DISPOSITION: _____

_____

_____

_____

€ APPROVED € APPROVED AS NOTED € DISAPPR0VED

CONTRACT ADMINISTRATOR'S
TECHNICAL REPRESENTATIVE: _____
Name Date

CONTRACT ADMINISTRATOR"S
QA REPRESENTATIVE: _____ _____
Name Date

CONTRACT ADMNISTRATOR: _____
Name Date

Section 11610 - Attachment 5
List of Required Submittals

****

The following list of required submittals is an example of the submittals required in association with the glovebox design and fabrication specification. This list is not comprehensive. Modify the list accordingly and provide the submittal requirements for project-specific gloveboxes with Section 01300 – Submittals.

****

Section No: 11610		Type of Submittal			Submittal Schedule and Number of Copies				
Section Title: Gloveboxes									
DESCRIPTION OF SUBMITTAL REQUIRED	SPECIFICATION LOCATION	FOR INFORMATION	FOR ENGINEERING REVIEW, COMMENT, & APPROVAL	FOR INSPECTION & ACCEPTANCE	AT PREFABRICATION CONFERENCE	PRIOR TO FRABRICATION	WITH SHIPMENT	7 WORKING DAYS ADVANCE NOTICE	AS REQUIRED
30% Design Documents									
Design Drawings									
60% Design Documents									
Design Drawings									
90% Design Documents									
Design Drawings									
Seismic Analyses									
100% Design Documents									
Final Design Drawings (stamped and signed)									
Final Seismic Analysis (stamped and signed)									
As-Built Drawings		X					1		
Lower Tier Services Plan		X			1				
Fabrication Schedule		X			1				
Bill of Lading		X					1		
Quality Assurance Manual (Design)									
Quality Assurance Manual (Fabrication)					1				
Fabrication and Quality Control (QC) Procedures (Include Rev # or Date):									
Welding Procedure Specifications (WPS)			X			1			

Section No: 11610		Type of Submittal			Submittal Schedule and Number of Copies				
Section Title: Gloveboxes									
DESCRIPTION OF SUBMITTAL REQUIRED	SPECIFICATION LOCATION	FOR INFORMATION	FOR ENGINEERING REVIEW, COMMENT, & APPROVAL	FOR INSPECTION & ACCEPTANCE	AT PREFABRICATION CONFERENCE	PRIOR TO FRABRICATION	WITH SHIPMENT	7 WORKING DAYS ADVANCE NOTICE	AS REQUIRED
Welding Procedure Qualification Record (PQR)			X			1			
Material Control Procedure			X			1			
Shop Traveler Procedure			X			1			
Cleaning Procedure			X			1			
Packaging Procedure			X			1			
Leak Test Procedure			X			1			
Liquid Penetrant Test Procedure			X			1			
Stud Test Procedure			X			1			
Calibration Procedure			X			1			
Welding & NDE Personnel List		X			1				
Personnel Qualifications:									
Welder Performance Qualification Records			X			1			
NDE Personnel Certifications			X			1			
Q.A. Document Package:									
Test Reports:									
Stud Test				X			1		
Liquid Penetrant Test				X			1		
Leak Test				X			1		
Material Certifications:									
Stainless Steel for Shell				X			1		
Other Stainless Steel Items				X			1		
Lead				X			1		
Weld Filler Materials				X			1		

Section No: 11610		Type of Submittal			Submittal Schedule and Number of Copies				
Section Title: Gloveboxes									
DESCRIPTION OF SUBMITTAL REQUIRED	SPECIFICATION LOCATION	FOR INFORMATION	FOR ENGINEERING REVIEW, COMMENT, & APPROVAL	FOR INSPECTION & ACCEPTANCE	AT PREFABRICATION CONFERENCE	PRIOR TO FRABRICATION	WITH SHIPMENT	7 WORKING DAYS ADVANCE NOTICE	AS REQUIRED
Chloride Content				X			1		
Shop Traveler, Completed				X			1		
Certificate of Compliance				X			1		
Supplier Deviation Disposition Request			X						1
Notification for Inspection of Weld Fit-up		X						1	
Notification for Inspection of Lead Placement		X						1	
Notification for Acceptance Testing & Final Inspection		X						1	

Section 11610 - Attachment 6
Guide to Suspect Fasteners

From *LANL Purchase Order Quality Clauses, January 1995, Form 838c (ST 2683), page 4 of 5* (from http://labs.ucop.edu/internet/sps/lanl.html, select SI 46.1 at http://labs.ucop.edu/internet/sps/lanl/46-1.pdf, then pdf page 12):

> 26. Suspect/Counterfeit Fasteners
>
> The University of California will not accept any hex-head cap screws (bolts) with any manufacturer's insignia identified on the attached Suspect Fastener Headmark List.
>
> 27. Suspect/Counterfeit Flanges
>
> The University of California will not accept any foreign manufactured flange and specifically any flange identified as China A-105 B16.

To access the Suspect/Counterfeit Fastener headmark list, open http://twilight.saic.com/qawg/training.htm , then open Suspect/Counterfeit Item booklet, click on View S/CI Booklet http://www.qmo.bnl.gov/DOESCI/bkltview.pdf, and open to page 23-24.

END OF SECTION